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community, as high as cotton is held amongst the raw staples demanded by our manufacturers; and indeed it would be difficult to know which of the two would be retained if the nation were called upon to sacrifice one or the other. The characteristic of the food of an Englishman has heretofore been roast-beef and beer; but, without interfering with the pre-eminence of those substances, we may certainly now add the further characteristic of tea, if, as in our laws, the female is held to be included in the male, and the term Englishman comprehends also that of Englishwoman.

Hence, I am relieved from any necessity for a lengthened introduction to our subject, and may at once proceed to consider the mode of action of this valuable substance upon the human system, with a view to determine the conditions to which it is, or is not, fitted; and to this I propose to add some observations to the ladies on the selection and preparation of tea for the table.

We have the authority of the most populous nation in the world for the statement that "tea is an exceedingly useful plant," and "that if we drink it the animal spirits will become lively and clear." They also affirm that it tends to "clear away impurities, to drive off drowsiness, and to remove or prevent headache." The Chinese have used the plant for more than 1,200 years; and, therefore, must have had, even with their notions of time, a good opportunity of forming a correct opinion upon its merits. We, also, a nation situated in a different climate, and living under very different conditions, have some experience on the same subject; for since the days of Charles II., some two centuries ago, when 2 lbs. of tea was a choice present for a Queen, we have reached a period when each man, woman, and child in the kingdom drinks, on the average, more than twice that quantity each year, and when the total British annual consumption of tea is upwards of eighty-six millions of pounds, and have arrived at the same conclusion—for that tea is "the cup which cheers and not inebriates" is a statement found amongst our household words. If to this conjoined testimony we add that of the extension of its daily use to the vast regions of Asiatic Russia, America, and Australia, and the increase in its consumption by every European State, we must admit that a remarkable unanimity exists as to its kind and degree of value for the welfare of mankind. Let us now seek to ascertain the mode of its action.

The late excellent writer, Professor Johnstone, in an article in his "Chemistry of Common Life," sought to explain its utility by reference to its chemical composition; and after discussing the effects of its principal ingredients, viz., the volatile oil, the theine, the tannin, and the gluten, arrived at the conclusion that tea lessens the waste of body by the theine, and supplies flesh-forming material by its gluten. He says, (but you will bear in mind that Professor Johnstone was a chemist, and not a physiologist) "the waste of the body is lessened by the use of tea, and if the waste be lessened, the necessity for food to repair it will be lessened in an equal proportion. Tea, therefore, saves food—stands, to a certain extent, in the place of food." This is a most important statement, and has reference to the theine as the peculiar active principle of tea, and to the gluten which is found in the leaves of tea and of other plants. He refers to the practice of the Tartar tribes, who drink the tea leaves powdered and dissolved in water, with salt and fat, and eat them with milk, butter, and roasted meal, and states that tea (but mark the other components), "first directly nourishes by the gluten and milk and meal it contains, and second, it makes this food go further by virtue of its theine." In further illustration, he cites the very utilitarian, and, if his statement be true, the rational mode of taking tea adopted by some of the inhabitants of South America, who, after drinking the infusion, eat the leaves.

This view raises a new question in the use of tea—one which seems to have escaped the attention of the Chinese, and is not found even in those mines of truth, the homely sayings of our own land, for it is said "to cheer,"

but it is not said "to nourish or fatten," and it is affirmed to "remove impurities," which must mean the removal of wasted and useless material, and not the supply of new material for digestion and transformation. Beers have been found to fatten the body, but it would be a new thing to feed a person on tea. We should expect such a person to become "small by degrees and beautifully less." Hence it is important to consider how far this statement, as to the nutritive properties of tea, is borne out either by the chemical composition of the leaf or by actual scientific observation of its effects upon the human system. The statement that tea cheers and removes impurities manifestly implies that it increases the transformation of food or tissue, for to cheer implies increased nervous action, and to remove material implies waste of the body; and hence, on the one hand, popular experience informs us that tea causes waste, and, on the other, science is appealed to to show that tea nourishes the body. Either these opinions contradict each other; or, as it may be possible to show, they are both, in a degree, true.

There are thus three questions raised in reference to the influence of tea:—

1. The waste of the body is lessened.
2. The body is nourished.
3. By lessening waste we may lessen supply, and yet the bodily powers shall be duly sustained.

We will first offer a few remarks upon each of these questions.

Now as to the value of theine, or the active principle of tea, in retarding waste of the body. It is to be observed that it has been deduced from the statement that it lessens the amount of nitrogenous or flesh-forming material which is thrown out of the body, and this has been stated on the authority of many, and is held to mean that thus the waste of the flesh of the body is lessened.

This last assertion was the opinion which Liebig introduced, and which has, until recently, controlled the scientific world. But now it is known that the waste of nitrogen, or the so-called flesh-forming material which is said to be lessened by tea, depends clearly upon at least three things:—1. The destruction of those tissues of the body which are composed of nitrogen; 2. The mere kind of food taken, as gelatine, for example, which, whilst it has small power to nourish the body, increases largely the excretion of nitrogen; and 3. Quantity, or perhaps excess of food, for two distinguished members of this Society, Messrs. Lawes and Gilbert, have shown incontestably that, if two pigs are fed on foods varying in the amount of nitrogen which they contain, they will differ in the same proportion in the amount of nitrogen which they will throw out. When, therefore, the excreted nitrogen may proceed from excess of food, or kind of food, or perhaps from unassimilated food, as well as from the tissues of the body, it is idle to regard its diminution as necessary evidence of the lessened waste of tissue. Hence, Prof. Johnstone's grounds for commending the use of tea cannot be conceded.

The different methods of inquiry to which I referred in my former paper are doubtless the causes of the discrepancy and errors in the results obtained by various observers. When doses of tea are added to, or given in place of, substances of unknown influence acting upon the system at the same time, it is impossible to determine their separate effect with certainty. As well might a banker keep the accounts of a particular customer, who had paid money into, and received money out of, the bank during the day, by placing to his debit or credit whatever difference might appear in the general cash at the end of that day, as compared with the amount noted at the end of the previous day, when hundreds had also paid in and received out variable sums on both days. Yet such has been the method adopted by those who affirm that tea lessens the waste of the body.

Böcker, whose experiments are more extended than those of any other observer, when comparing the effects of tea and coffee with other foods, fell into the great error of omitting a pint or even a quart of milk for breakfast when

he took tea or coffee, and of drinking it when he would compare the two sets of results together. Now, tea and coffee offer scarcely any nitrogen to the system, whilst milk gives 44 grains in every pint, and hence he might well find that less nitrogen was given out when tea or coffee was taken, than when milk was taken, but without at all showing that the tea or coffee lessened the excretion of the nitrogen.

But opposed to these results we have those of Professor C. G. Lehmann and my own. Professor Lehmann, a most distinguished German chemist and physiologist, and the most distinguished writer on physiology on the Continent of Europe, found the contrary, and proved that tea increases the emission of such compounds; and he remarks that he cannot say whether this was due to the increase of all the vital actions of the body which accompanied its use, and which would cause increased waste of all kinds, or to the nitrogen which it contained, and which, being in excess of the wants of the body, would thus be thrown off.—(*Physiol. Chemistry*, Vol. II., p. 419.)

In some experiments which we made upon four prisoners, kept under absolutely uniform conditions, to whom we gave tea and coffee each for three days during a part of the inquiry, we found a diminution in the excretion of nitrogen but for one day only, and at the end of the six days the quantity was more than 30 grains per day greater than it had been on the day before the experiment began, as is shown in the diagram on the wall. During this period, however, there was no diminution in the quantity of water eliminated.

That there is increased and not decreased vital action due to tea is familiar to us in its effect in preventing sleep; and is affirmed by the Chinese, when they state that "if it be drunk too freely it will produce exhaustion and lassitude," and if there be increased action in the body, there must be increased waste, as surely as that a wheel cannot be driven round with increasing velocity without causing increased friction, and increased waste of its own structure, or of the lubricating oil, or of the substance upon which it revolves. Hence we think that on this evidence the property of theine in retarding waste, and thereby lessening the necessity for food, must submit to the Scottish verdict of "not proven."

Then as to the gluten, which is said to nourish the body. Good tea leaves contain 20 per cent. of gluten, but boiling water will take up only 16 per cent. of the leaf, including all the four substances already referred to, and hence the amount of gluten which we actually drink in an infusion of tea cannot exceed about 8 per cent. of the weight of the tea leaves employed. Now, if we use the eighth part of an ounce of tea, or 55 grains, the total available gluten would be about four grains, and this quantity contains two-thirds of a grain of nitrogen. If we assume that the quantity of tea employed at a meal is twice that just mentioned, and that it is taken two or three times a day, we shall see the utter insignificance of its gluten when compared with the 250 grains of nitrogen which is otherwise supplied in food and also evolved from the body daily. Hence it is quite clear that we cannot regard tea as a nutritious food simply because it affords this very minute quantity of nitrogen or flesh-forming material; but although the theory cannot be sustained on the ground indicated, we hope to be able to show that there is a sense in which tea by its gluten may improve nutrition, whilst in other conditions it may waste the system.

The real ground of Professor Johnstone's theory is not, however, the quantity of nitrogen supplied, but the indefinite assertion that by some unknown means it lessens the waste of the system.

Now, as to the advantage of lessening waste and supply. Having very recently in this room had occasion to discuss the question of waste, I will only now remind you of the fallacy of assuming that in a state of health you may lessen the waste for a long period with benefit to the system, for there must manifestly be a proper balance maintained between want and supply, and if you lessen both, as Professor Johnstone

thought was the desirable action of tea on the aged, you lessen the vital action—in fact lessen life. All agencies (if there are any such except inaction) which lessen waste are only to be used in an emergency, until a due supply can be obtained, and due waste be again permitted, and such are states rather of disease than health. A merchant may be glad to find a diminution of his liabilities (or waste), but he does not look with complacency upon a proportionate and co-existent diminution of income (or supply); for whilst the one will still balance the other, he knows that it proves that his transactions are fewer and his business falling off, and that soon things will be so nicely reduced, and yet balanced, that he may close his doors. Just so is it with the human system—there must be a due amount of vital action both in supply and waste, and neither can be lessened without danger.

Hence, taking into account the known stimulating action of tea, the sources of error in the investigations heretofore made, and the results of Professor Lehmann's, as well as my own researches, I venture to affirm that there are no good grounds for stating that tea lessens the waste of the body; but I believe that it increases the products of excretion, whether from food or tissue, by increasing the vital actions. Whether this increased waste will really cause loss of weight of the body, will depend upon the amount of food supplied and the capability to transform it. Mr. Milner, surgeon to the Wakefield Gaol, in a paper which he read before the British Association in Leeds, in 1858, showed that the prisoners lost weight on the average, in a greater degree, when tea was given either in place of gruel or in addition to the gruel, a fact which shows both the direction of the action of the tea, as just indicated, and the very even balance maintained between the waste and the supply of the system in the usual dietary of these prisoners. To this question I shall again refer.

But we must not pass without notice the remarks made by Professor Johnstone on the volatile oil found in tea. This principle, although it has not yet been separately investigated, has doubtless the greatest value. It gives the flavour and odour to the tea, and upon its quality the monetary, but not necessarily the dietetic, value of teas in the market and on the table is determined. The theine and the gluten are not considered by tea merchants, and the quantity of theine is not determined by the taste. To this substance is to be attributed the headaches and nervous derangements of tea tasters, who, be it observed, only taste and do not swallow the tea, and it is said to cause even paralysis in those who have the constant duty of handling tea. Hence it is impossible not to attach great value to this substance when considering the ingredients of tea which act upon the body—an importance quite as great as that which we in a former paper attached to the aromas of pure wines; and I regret very much that I have not had the opportunity of making separate experiments upon it. The Chinese find it the most abundant in new teas, and knowing its powerful and deleterious influence, they do not use tea less than one year old, by which time it is presumed that a quantity of the volatile oil has become dissipated. The amount of it found in the dried leaf is said to be about 1 per cent. There are *prima facie* grounds for thinking that its action is that of a narcotic, and, therefore, opposed to some of the other ingredients, much as the aromas of wines have a similar action, and are quite different from that of the alcohol associated with them.

Being fully impressed with the desirability of setting at rest various questions which have arisen as to the action of our ordinary food both in the interests of the whole community and in those of science, I have during the past years prosecuted a new series of many thousands of inquiries, the details of which have been published in the Transactions of the Royal Society for 1859.

The direction of the inquiries referred to, but not made, by Professor Johnstone was, as already mentioned, the determination of the amount of nitrogen or flesh-forming material thrown off by the body under the influence of the food

in question, and as it was found that the evolution of that substance was decreased, it was assumed that the tissues of the body were undergoing less than the usual amount of waste. The direction which we have chosen has embraced the other great function, viz., the heat-forming function of the body, and has been effected by determining the amount of chemical change proceeding in the respiratory or heat-forming process, it being understood that with increased chemical change there will be increased production of heat and increased waste of food or tissue. As these are the two chief functions of the body, it is of importance that the influence of any special food upon both of them should be investigated before any attempts are made to apply the knowledge gained from either of them to practice, and by the two sets of inquiries now referred to we believe that this has now been effected. It will, however, be evident that in such inquiries there is a great liability to error, from the unknown and co-existent influence of other causes, and therefore the food experimented upon should be taken only in the quantity which man is accustomed to use, and apart from any other food, and in conditions of body which will be uniform, and interfere as little as possible with the vital actions. In the inquiry now to be referred to, we took a moderate quantity of the tea, and took it alone, while the body was at perfect rest, and in the sitting posture. It was also taken in the morning before breakfast, when the system is the most sensitive to all impressions, and when therefore the effects of the food could be distinctly appreciated. Various other precautions were taken to avoid error, but this short description of the method employed may suffice to show both the kind of inquiry and the degree of confidence to which it is entitled.

The experiments embraced the action of tea in various doses, from 25 grains to 150 grains, black and green tea—cold and hot infusions—with or without the addition of sugar, acids, and alkalies, and taken alone, as before mentioned, or after having taken other substances, as alcohols; and, indeed, under every circumstance which in any way bore upon the habits of mankind.

When tea of the finest quality was taken in the moderate dose of one-eighth to one-quarter of an ounce, infused in 10 ounces of boiling water, and drunk without any addition whatever, it uniformly, and in every experiment increased the respiratory changes, so that there was an increase of from one-quarter to one-fifth in the quantity of carbonic acid which was evolved by the lungs. This increase was rapid, and followed a definite course, so that with a perceptible effect in ten minutes, the greatest effect occurred in 45 or 50 minutes, and the whole effect subsided in from an hour to an hour and a half. There was in fact a progressive increase to a maximum, and then a progressive decrease until the whole effect ceased. With this increase in the chemical changes there was also increased frequency and depth of respiration, so that more air was inspired, and the act of respiration was performed with greater ease, frequency, and completeness. The sense of "lightness" was very marked, and was chiefly referable to the ease of respiration, whilst the cheerfulness which we have already quoted was uniformly and delightfully present. It will interest those who have adopted the system of small doses in physic to know that small doses of tea also when often repeated, have greater effect than one large dose; so that 25 grains, or a small pinch of tea, when taken every quarter of an hour for six doses, produces fourfold the effect of 150 grains taken at once, and the action is much more uniform and sustained. It is also worthy of remark that the quantity which we ordinarily take is that which produces the greatest effect, for 50 to 100 grains usually produce a greater effect than 150 grains. The latter dose became indeed a poisonous one, for it sometimes induced a distressing temporary nausea, and at others a moderate amount of narcotism. It is well that the student who wishes to maintain mental activity under difficulties should be informed that tea will aid him far better when drank in sips over a lengthened period than in the larger quantity taken within a few minutes at ordinary meals. It

is also remarkable that this substance does not increase the frequency or force of pulsation when taken in moderate doses; and to the absence of increased pulsation must be attributed that calmness which attends upon, and greatly adds to the value of, the cheerfulness which results from the use of tea. These various effects are shown upon the Diagram placed at the end of this paper, on which the results of numerous experiments are delineated, and to which we invite a little patient attention.

The number of experiments made by us amount to many hundreds, and far exceed all that has been recorded by all previous inquirers, and in no instance were the results different from those just described. Hence it is impossible to doubt even, much less to deny, that tea increases the respiratory function. But those observers who have affirmed that tea lessens the amount of nitrogen evolved, also affirm that it lessens the amount of carbonic acid produced, but, as I have observed in the paper on alcohol, Prout and Hammond obtained only the percentage, and not the total amount, and others mixed up the influence of the tea or the alcohol with ordinary food having an unknown influence. I appeal with confidence to the diagrams before you, to the method which we adopted, and to your own sensations as proofs of the fact that tea increases the respiratory changes, and that in a marked and uniform degree.

I have elsewhere shown that the increase in the carbonic acid evolved under the influence of tea could not have been obtained from the tea itself, for, independently of the rapidity of the effect, the quantity of carbon evolved was much greater than was contained in the tea. Hence the very important deduction follows, that tea has the power to increase the transformation of other food, and particularly of such as contains carbon. This is probably due to the gluten which the tea contains, and which acts as a ferment.

Another kind of action, of great importance, is that which tea exerts in increasing the function of the skin, as is seen by the perspiration which often follows its use. This is the explanation of the fact which is taught by the Chinese when they say that "tea is of a cooling nature" and may be freely drank under a burning sun, a statement with which popular experience in this climate fully agrees, and it is due to a physical effect which may be thus explained: When a fluid is converted into vapour it absorbs, during that conversion, 1,000 times as much heat as it required when in its fluid state, and as this heat is rendered latent, and is essential to the constitution of the vapour, it must be abstracted from the surrounding objects and thus reduce their temperature. The action of the skin is chiefly that of regulating the temperature of the body, partly by the direct radiation of heat, but chiefly by this process of evaporation, and the rapidity with which the latter is carried on, measures the sensation of cold which will attend the abstraction of heat from the surface of the body. In this point of view the skin is the most important organ in the body, for as it regulates the heat of the body, so it must regulate the activity of all the internal organs which produce the heat and control the necessity for food, or fuel for the fire. The uniform action of tea, when it agrees with us, is to increase the rapidity of evaporation, and in hot weather, and when taken with hot water, the perspiration is often times very profuse, and the subsequent cooling proportionately rapid.

This valuable property of tea is perhaps instinctively modified by various nations, according to the wants of the consumers, those wants varying with temperature and also with the amount and kind of food which is attainable by them. Thus, the Chinese inform us that "the country people," viz., those exposed to great temperature, but without abundant food, "before drinking it, add ginger and salt to counteract this cooling property;" whilst the Russians, living in great cold, add an acid, as lemon-juice, and in this country we add cream. The mode of action of all these additions is the same, viz.: their tendency to restrain the action of the skin, and thereby to coun-

teract this special effect of tea. It is known that the opulent Chinese drink a plain and weak infusion by sips in the circumstances in which they are placed, and this can be well defended by the experiments now recorded; but it has not been hitherto known why we, inhabiting a different climate, add milk or cream to our tea with the same effect. If any one will notice the effect of a basin of milk when taken alone, he will find that the hands and the exposed parts of the skin become hot and dry, and will at once appreciate the fact that the addition of milk or fat to tea has the effect just mentioned—that of preventing the increase of perspiration and thereby the cooling of the body.

I do not know of any evidence to show that alkalies are ever added to tea with an intelligent view to the opposite state—that in which the action of the tea upon the skin is increased; but many are familiar with the fact that in this climate we add soda in small quantities, or use soft waters, with the ostensible desire to obtain a more coloured infusion. Professor Johnstone, in reference to this habit, offers the chemical explanation of the more ready dissolution of gluten on the addition of an alkali, but we venture to ask those who adopt this plan to ascertain if it be not rather due to some instinctive desire to cool the body, and would also put the same question to those who are not in the habit of taking milk or cream in their tea.

As we have referred to this matter, it may be better to state that the sugar which we add to the tea tends largely to increase the action of the latter, both upon the respiration and the skin, sugar having indeed in some respects, an action very analogous to that of tea, both in nature and degree, so that the Frenchman drinks his sugar and water as the Chinese and ourselves drink tea. Hence in a cup of tea, as ordinarily drunk in this country, we take three ingredients besides the hot water, two of which coincide in their action, and one which is opposed to them. This habit is not practised in China, and there are many in this country who take only two of the three ingredients, but very few who take the tea alone.

Moreover, when ginger, acids, milk, or fats are added to the tea there is a tendency to increase pulsation—another mode by which the action of tea is opposed, and thus the tea becomes more stimulating, but when an alkali, as carbonate of soda, is added to the tea, the soothing property of it is increased.

Thus, on a review of the foregoing experiments, we observe that the two sets of inquiries into the action of tea are harmonious, and tea has the power to increase the amount both of carbonic acid and of urea evolved; and without occupying your attention with further detail, I may sum up the foregoing remarks by stating, that *the essential action of tea is to promote all vital actions and to increase the action of the skin.* Hence it increases the assimilation of food, both of the flesh and heat-forming kinds, and with abundance of food it must promote nutrition, whilst in the absence of sufficient food it increases the waste of the body.

Having thus arrived at the knowledge of the true action of this substance, we are prepared to endeavour to ascertain the states of body, or the external conditions in which its use is proper and improper, and whilst we think this will be an easy task, we hope to be able to show that much greater discrimination ought to be employed than has hitherto been observed.

The basis of this part of our inquiry is clearly the relation between the waste of the system and the supply of food to meet that waste, and this idea must be ever present in the mind during the discussion, for the foregoing remarks show that as tea increases all vital action, it must increase the waste of the body, *unless there be a supply of food upon which it may first act.*

In pursuing this subject we must admit that tea is not applicable under the following conditions, viz.—

1. In the absence of food, for then it must increase the waste of the body. If, however, it follow a large meal, as the dinner, the system is then replete with food, and

although no food may be taken with the tea, the tea cannot be said to be taken in the absence of food.

2. At breakfast, except there remains unused food from the supper on the previous night, or except the system be usually too full of nutritive material, as in those who dine heartily at a late hour.

3. To the ill-fed, except there is also deficient power to transform the kind of food attainable.

4. To those of spare habit, in whom all the vital actions are performed with much activity.

5. To a prison or other dietary, in which it is a duty to society that the food supplied should not exceed the wants of the system.

6. To exertion, for exertion is itself the most powerful exciter of waste.

7. To low temperatures, except in connection with abundant food and clothing, and with the addition of milk, fat, acid, or ginger.

8. To those who habitually perspire too freely, unless (as is then seldom the case) there be an excessive supply of food.

9. To those cases in hot climates where the appetite is defective and the skin active.

10. To the young, in whom there is naturally the maximum amount of vital action.

11. With our principal meals, or those at which we take the greater part of our animal food, for after such meals a dry and hot skin, that is, lessened action of the skin, is a natural effect, and this would be opposed by the tea. It is worthy of note that neither the Chinese, nor any other nation, usually take tea under this last condition.

Such are some of the conditions in which tea should be withheld, and in reference to most of them the results of science correspond with actual practice. It is not usual to give tea to children, or with animal food, as at dinner, or at breakfast, or in prisons, and we seek a stronger beverage in hot weather and during exertion; but it is universally taken in the afternoon and evening, and after dinner, when the vital actions are declining and there is felt to be excess of food in the system. It is not taken alone as a meal, or with the idea of taking nourishment. Yet with all this instinctive propriety, the cautions now given are not universally adopted, and in such instances as in those who perspire freely, and those of spare habit, much ignorance prevails, to their own detriment.

The subject of low temperatures and exertion raises that of the fitness of tea to supplant spirituous liquors in the dietary of our sailors when residing in the Arctic regions, and has given rise to much difference of opinion. In a recent work on Arctic voyages, it is affirmed that after the first year's residence the appetite for food changed, so that large quantities of fat were consumed, and tea was found to be highly acceptable and beneficial. The explanation of this last fact appears upon the face of the statement, for it was the excessive quantity of fat which, by its action in lessening the activity of the skin, as well as by the necessity for its own transformation, rendered the action of tea desirable. Dr. Kane, in his interesting work, states that his crew were pledged to the avoidance of spirituous liquors, but in one period of exposure and fatigue of great danger, he gave them brandy; at another period, when great labour was temporarily required in great cold, he gave them hot coffee; and in their ordinary dietary he authorised tea, but he does not give any grounds for this variation. We are informed by an Arctic navigator of great experience and high position, Sir James Ross, K.C.B., F.R.S., that this large increase in the consumption of fat in the Arctic region is not necessary, provided the quantity habitually supplied to sailors is duly eaten; and it is quite clear that in the absence of an unusual quantity of salt or fat, or some other substance, which tends to lessen the evaporation from the skin, the use of tea is not especially indicated. The problem is one of a mixed nature, each part of which must be investigated before a truthful conclusion can be arrived at.

That sailors can do their work better with tea than with

other beverages cannot be, as already proved, because it supplies nourishment, but because it causes the avoidance of a disturbing and therefore evil habit, or promotes the digestion of food, as will be shortly pointed out.

We may now briefly look at the opposite view of the question, and point out the states in which the use of tea is clearly beneficial. These are—

1. Some time after a full meal, when the system is oppressed by food, or by the heat produced in its conversion.
2. In the after part of the day, when the body is full of partly-digested food, and when the activity of the transforming function is considerably lessened.
3. For the corpulent.
4. For some of those in whom the vital actions proceed slowly, and in whom the power of transforming food is greatly lessened.
5. For the old, with their deficient vital actions.
6. For hot climates, and especially to those who, living there, eat freely and drink milk or alcohols.
7. In cases of suspended animation, as from drowning, where the object is to restore the respiratory functions—an object more likely to be assisted by hot tea than by brandy.
8. For those who eat much starchy (bread, rice, &c.) and fat food, and especially if they do not take flesh. This is due to the fact that our experiments have proved that tea clearly promotes the transformation of starch and probably also of fat—in the former case by means of its gluten, which doubtless acts as a ferment in reference to the starch.
9. For soldiers, who in time of peace take too much food in relation to the waste proceeding in the body.
10. For soldiers and others marching in the heat of eastern climates, for then, by promoting evaporation and cooling the body, it prevents in a degree the effect of too much food and of too great heat. For this purpose a cold infusion may be used (as a hot infusion could not be obtained); of this a quantity equal to 25 grains of tea should be taken often during exposure. We urge this upon the consideration of our military authorities, in the conviction of its great value in preventing the occurrence of sun-stroke and of other diseased states of system due to excess of heat, and have entered into the subject more in detail in a short paper published in the *Medical Times and Gazette* for 1860.
11. For the sedentary, who require increased vital action.
12. For those who have usually a dry and non-perspiring skin.

All these conditions resolve themselves into this general law that tea is beneficial in all conditions in which there is temporary excess of food regarded in relation to the necessity of the system for it and the power to transform it.

Such is a concise view of the results of our enquiry into the influence of tea, and we cannot but think that it will suggest to thoughtful minds material for reflection and practical application. It is evident that the way the instinctive cravings of man find expression in the (right) use of this article of food, with singular unanimity, under the most diverse circumstances of climate and condition, confirms the truthfulness of scientific research, whilst at the same time there is much reason to fear that in our own country the indiscriminate employment of a substance which possesses great power, is daily leading a large portion of the community to their own injury.

We hinted, in the earlier part of this paper, at the possibility of showing that there is truth both in the statement made by Professor Johnstone and in those which are now offered, although the former asserts that tea nourishes, while the latter demonstrate that it may waste the system. The key to the solution of this enigma is found in the explanation of the source of the nitrogenous or flesh-forming material which is thrown out of the body under the influence of tea. It has recently been shown that this is partly due to the waste of tissue, partly to the

conversion of food, and partly to excess of food. Hence, if tea cause an increase, it may do so by the second method, and, therefore, whilst it does cause this increased waste, it at the same time nourishes the body, for it causes also the more perfect assimilation and an increased consumption of food. This explanation at once reconciles the two statements, but only in the conditions—1st, in which there is abundant food; and, 2nd, when food, whether sufficient or insufficient, is not properly digested or transformed. The sagacious Baron Von Liebig pointed out the analogy between the active principle of tea and the active principle of the bile, and both doubtless tend to the common end of promoting the digestion of food. All parties, be it remembered, agree that tea acts beneficially upon the system, and the only difference of statement is whether it acts by lessening the waste of the body, and, therefore, is useful only to the ill-fed, or, by promoting the transformation of food and removing excess, whereby it is more or less advantageous to all classes.

This is the truth at which our experiments have brought us, and we may close these remarks with a summary of the effects of tea in the following words: If there be an abundance of food in the system, and that especially of the farinaceous or fat kinds, tea is a powerful digestive agent, and by promoting the transformation of food it aids in nourishing the body; but with a deficiency of food in relation to the waste of the tissues by exertion, or the waste of heat by cold or by too profuse evaporation from the skin, it wastes the tissues of the body and lowers the vital powers. With deficient food, as in the case of the poor basket women, but with deficient powers of transforming or digesting it, tea will promote digestion and thereby indirectly nourish the system, although it will increase the vital actions. The three parts of the problem are want, supply, and transformation.

I must add a word in reference to those cases in which tea is not found to be beneficial. Tea is known to act very differently on different persons, and I am informed by one gentleman that he never takes it without finding an accumulation of water in his body, as shewn by a small dropsical effusion into the skin; and if retention of water were shown to be at all general, it would account for the temporary diminution in the excretion of nitrogen. The most distinguished medical man of the day, when asking if I had noticed any difference in the effects of green and black tea, expressed his conviction that the former was the more powerful. The explanation of this is clear—green tea, if fine, undoubtedly contains more of the chemical elements of tea than ordinary black tea, for it is commonly the young or newly-formed leaves, and is not fermented, but the true reason is the greater weight of green when compared bulk for bulk with black tea, so that one tea spoonfull of green is heavier than two of black. Hence those who drink green, drink very strong tea (comparatively colourless though it be), and it may well have greater influence upon them. Another very distinguished chemist informed me that after taking tea or coffee for a few days he became irritable and peevish, and was obliged to discontinue it for a short time. Many complain of the effect of tea upon the stomach, causing a grinding or gnawing pain, and leading to indigestion, and this is probably due to the tannin which is found naturally in tea, but more commonly added to it in the form of valonia, with a view to give it a rougher and stronger flavour. When it is taken for breakfast it more commonly causes indigestion, owing to the sensitive condition of the system, and the absence of any accumulation of food. The wakefulness which follows the use of tea in many persons is doubtless the effect of increase in the vital actions, conjoined sometimes with the above-mentioned effect upon the stomach, and it, in some degree, follows the use of any other agent which acts in a similar manner, but in many instances it is due to the action of the tannin upon the coats of the stomach.

I shall now close this discussion on tea with some remarks specially addressed to the excellent housewives,

without whose presence the tea-table would be cheerless, notwithstanding the enlivening properties of tea, and with all deference and courtesy offer the following suggestions for their guidance, when selecting and preparing this most welcome cup :—

First in the selection of tea.

There is both much ignorance and much mystery in nearly all minds in reference to the selection of tea. Generally, I believe, we are guided by the price, by our opinion of the strength of the tea, and by the quality which the tea dealer may chance to send. But it will not be difficult to point out a few particulars by which this evil may be remedied, and ladies be led to act with that intelligence in this which marks their conduct in other matters.

There are green and black teas, but they are all the product of the same kind of plant, yet the green tea is commonly produced in a different district from the black teas, and the different varieties of black teas are grown in different localities. In this respect it may be compared to wine, which we know obtains different flavours and qualities according to the locality in which it is produced, and yet all varieties are derived from the grape.

There are six kinds of green teas, viz., gunpowder, imperial, young hyson, hyson, twankay, and hyson skin, but all are produced from the very same tree. Thus, a green tea planter pulls all the leaves off the trees and mixes them together. They are then taken to the manufactory, where, being placed upon a heated plate of metal, twisted in various ways by the rotatory movement of the hand, and curled up in various degrees by the heat applied, a mixture is produced which contains all the kinds just mentioned. The leaves which are curled up the closest are sieved out, and this constitutes gunpowder, the next size above is the imperial, the next the young hyson, and so on to the twankay and hyson skin, which are the largest leaves, and thence the least curled by the process employed. As a rule, the younger the leaf the more readily and more completely it curls up, and hence the gunpowder is commonly the youngest leaf, and the twankay and hyson skin the larger and older leaves. This process may be roughly illustrated by referring to the manufacture of shot. The lead is melted at the top of a tower, and falls into water at the foot of the tower, where, on examination, it is found to consist of grains of various sizes. It is then passed through sieves having holes of various dimensions, and is separated into the numerous sizes of shot which are found in our shops. In both the manufacture of the tea and the shot alike, there is a common mass, and the final distribution is regulated simply by size. The teas thus assorted are packed in boxes, and the whole quantity, called a chop of tea, is sent to the market. The Americans are wise enough to take all the larger teas, which are cheap, and leave us the small teas, at a doubly or trebly increased price. Black teas gain their colour by fermentation, and are of three principal kinds, souchong, congou, and pekoe. Formerly there was also bohea, but that is not now brought to this country. The term pekoe means flower, but it is applied to specimens which do not contain the flower. Souchong and pekoe are the finest teas, but are comparatively rare. Congou is the kind of black tea almost universally sold.

It must next be borne in mind that, whilst there are so many kinds of tea, each kind is liable to vary greatly in quality, so that the mere name of the tea is no evidence of its real value. At this point, we see the importance of taste and technical knowledge as to the manufacture of tea which experience alone can give, for by this, and not by the name of the tea, the price is attached to it. Hence in selecting a tea, it is needful to remember that the qualities of even genuine tea vary so much that the quantity of its valuable constituents is nearly three times greater in the best than in the commonest kinds. Therefore, tea must not be accepted simply because it is tea, neither must equal quantities of a good or bad tea be employed. The best tea is that

which contains part of the flower and the youngest leaves of the plant. My friend, Mr. James Moul, informs me that the finest kinds of green tea, whatever the process of preparation, have a pale yellowish leaf. The infusion should be perfectly clear, without sediment, and should possess a delicate tinge of yellow. In black tea, the leaves should be of a reddish or brownish black, fragrant, and free from any artificial scent, and the infusion should be clear and of a bright red. The beautiful perfumes from artificially-scented teas, as, for example, orange-flavoured pekoe, are not derived from the tea—have no property in common with the tea, and are drawn out and dissipated with the first cup, and therefore are valueless, and to be avoided. The natural colour of the leaf, when growing upon the tree, is a dullish green, and hence amongst green teas, those which have a pale colour are more natural, and are generally those of the finest qualities, but the bright green teas are usually coloured artificially or glazed, and are not of the best qualities.

It will be found that teas differ in weight bulk for bulk, that is to say there will be more spoonfuls in a pound of one kind than in the same weight of another kind, as, for example, the heavy small, round leaf gunpowder as compared with the light, long, twisted, and wiry-leaf congou, souchong, and pekoe. To this I am anxious to ask your earnest attention for a moment. The common test of the spoonful is fallacious, both as respects the real amount of tea supplied and the relative cost of each day's consumption. One tea spoonful for each person, and one for the pot, as our mothers directed us to use, will make an infusion more or less strong, more or less valuable, and more or less costly, according to the weight of that quantity. I now show to you several specimens of teas, kindly furnished by Mr. Moul, and will prove to you in how great a degree the bulk and weight differ. The weight of a fairly and evenly taken caddy spoonful of each of these teas, and the number of tea spoonfuls in the lb., is as follows:—

BLACK TEAS.

	Grains.	Spoonfuls per lb.
Oolong	39	179
Inferior congou, large leaf ...	52	138
Flowery pekoe	62	113
Souchong	70	100
Fine congou	87	80

GREEN TEAS.

Hyson skin	58	120
Twankay	70	100
Hyson	66	106
Fine imperial	90	77
Scented caper	103	68
Fine gunpowder	123	57

All these are pure teas except the scented caper. It is not presumed that the relation of these weights is absolutely true, for no two spoonfuls of the same tea would contain precisely the same quantity, but they are at least as near an approximation to the truth as is the actual result of any one measuring tea by spoonfuls in ordinary use. Hence it is seen, that even amongst black teas there are kinds which are twice as heavy as others, and when extremes are taken of black and green tea the difference of weight is more than three times. It is, therefore, unreasonable for the good housewife to expect to find the same strength and flavour from equal bulks of different teas, and if she should be induced to use more of a light than of a heavy tea, she may take comfort from the thought that she is not adding to her expenses, for if all the kinds above-mentioned were sold at the same price she might use two or three spoonfuls of black tea for the same cost as the spoonful of green, viz., fine gunpowder. Ignorance and inattention to this matter often cause the consumer to complain without reason to the tea dealer. It is very desirable, although not perhaps practicable, that tea should be used by weight and not by bulk, and the more so that there is no definite relation between variation

in weight and variation in quality of tea, except the general one just pointed out.

It is, however, to be well understood, that there is but little relation between the market value of the expensive kinds of tea and their true value upon the system, not such a value as would enable any one to state, that because a certain kind of tea is costly, it therefore contains more theine. The flavours of tea must be regarded as luxuries, just as we value the delicate and peculiar flavours of certain Rhenish wines, and as the quantity of such tea is small and the supply variable, so most those pay highly for it who have taste enough to attach a high value to it. It is known that the teas of the choicest flavour are never exported from China, and from their great value are drunk only by the wealthy classes, whilst the finest teas which are exported find their way by the Caravan route to Russia, and there sell at almost a fabulous price. Such teas when made weak may, without any difficulty, be drunk without milk and sugar, and then true bouquet and flavour are enjoyed in the same manner and degree that a connoisseur enjoys his finest wines.

But for all useful purposes it is better to obtain the good qualities of the so-called inferior kinds, as for example in green teas, the hyson skin, or young hyson, sold at 1s. to 1s. 6d. per lb., instead of the gunpowder sold at 3s. per lb. besides the duty. We may also fairly lay aside all prejudices as to the use of uncolored green tea, since it must have occurred to you, on hearing this paper, that the color of the infusion is no test whatever of the quality of the tea; the pale infusion of the green tea often containing far more tea than the black infusion of highly dried and rough black teas. Of black teas I would strongly recommend the Oolong tea of good quality, for although the colour of the infusion is light, it causes a choice bouquet and is pungent without being rough to the palate. I am informed that dealers find some difficulty in disposing of this tea, for whilst its price is not low, its infusion being light, is ignorantly thought to be weak. It has also the merit of being a bulky tea, and one, therefore, in which the consumer may cheat himself into habits of economy.

Second, as to the quantity of tea to be infused.

We have already stated that a moderate is preferable to a large quantity, provided good tea be selected, but it is evident that a larger quantity of coarse leaf than of fine leaf tea must be employed. Of the very finest teas used in China, a small pinch is taken as the suitable modicum. The lower orders of the Chinese obtain only the coarser kinds of tea, but even these are of good quality as compared with our inferior teas, since they are not so highly dried as those which are exported. They drink tea thus prepared in very large quantities, and there are for their convenience multitudes of tea shops, where they may obtain a quantity of the inferior infusion of tea at a very small cost.

We advise that the tea be not made "strong," but that it have a good body and fine flavour to the palate.

Third. The mode of preparation.

It is an invariable practice amongst professional "tea tasters" never to make the infusion with water which has been already boiled, but on the contrary to take fresh water and use it immediately it boils. We are informed by Mr. Fortune that the Chinese are equally careful on this point, and that very minute directions are given by their writers, thus:—"The fire must be lively and clear, but the water must not be boiled too hastily. At first it begins to sparkle like crab's eyes, then somewhat like fish's eyes, and lastly it boils up like pearls innumerable, springing and waving about." There may be something fanciful in this description, but it no doubt represents a truth in reference to the expulsion of the air which is naturally found in water, and we certainly commend the example to our gentle hearers.

Every good housewife knows too well the influence of kinds of water in making tea to render it desirable that we should dwell upon it, but we would recall to their minds that the water to be abhorred is stagnant and hard water, and that to be preferred is running and soft water.

The Chinese direction is imperative, viz.; "take it from a running stream, that from hill springs is the best, river water is the next, and well water is the worst." We fear that these directions will be in some degree lost upon those who live in our great towns, who must use water which is not always clear, pure, and soft. Let them, however, filter it, and add carbonate of soda to it—the least pinch in winter, and a little more in summer. With hard water it is impossible to make good tea.

I have only one word to add: viz., make the tea yourselves, and allow it to infuse for ten minutes.

It was my intention to have offered some observations upon the action of coffee, since it is so closely allied to, and yet in some respects so different from, tea; but the time allowed to me forbade my doing so. I would, therefore, in concluding this paper, offer one observation of general import. We must not, and we do not, regard the substance which have now been discussed in the light of ordinary food, for it cannot supply the place of food, and alone cannot nourish the body. Even admitting that the elements are not unsuited as food, the quantity which we take offers no proportion to the quantity of those elements which must be supplied to the body daily. Their real power is to modify the influence of true foods, and we have shown that in this respect they are most valuable. But there is another view of the matter which cannot be forgotten. The system requires from two to three pints of fluid per day to enable it to appropriate the solid food and to rid itself of waste and useless material. This must be taken as water alone or with such substances as tea and coffee infused in it, or as milk, or as some form of alcohol. We must either drink a quart of milk or a quart of beer per day, as our forefathers did, or we must use such beverages as tea and coffee. With this moreover, there is a call for increase of heat in the body, and particularly in cold weather, in the absence of food, and in the ill-fed. This is met either by the use of warm drinks or by fluids as beer or other alcohols, which stimulate and give a sensation of warmth within. It has often been asked why poor hard-working women relish their tea so greatly, and the answer has been either that it nourished them, or, by lessening the waste of their bodies, it enabled the food to go further. The true answer must contain three items: the tea cheers and increases vital action, enables the bread to be more quickly digested, and the heat of the fluid supplies a comfortable warmth. No fluid meets these requirements better at the same cost, but all would admit that if the poor could obtain hot milk it would be found to be far more beneficial.

In some experiments made upon myself, in which for several days I tried to live on bread and water only, I found it to be absolutely necessary that the water should be warmed, both that it should not abstract heat from, and that it should give heat to the body. Those only who have tried this can appreciate the value of warmth in our beverages, and may well pity the poor creatures too often hastily condemned for "prison" offences to the dark cell and bread and cold water.

Let those whose aim it is to lessen the amount of alcoholic drinks consumed by our hard-working poor people, bear in mind that some other suitable fluid should be found for them, and it would confer the greatest boon to teach them the true value of milk, and to increase the facilities by which hot, wholesome milk, tea, coffee, and cocoa, might be obtained in a comfortable and economical manner.

EXPLANATION OF THE DIAGRAM.

The diagram, extracted from the *Philosophical Transactions* for 1859, exhibits the effects of tea upon three persons in good health, and in the morning before breakfast, and shows the quantity of carbonic acid in grains per minute expired by the lungs, the amount of air in cubic inches inspired at each inspiration, the total quantity of air in cubic inches inspired per minute, and the rate of pulsation per minute. The quantity of tea with the substances added to it, the temperature of the air, and the height of the

barometer, are recorded at the head of each series of experiments. In all the experiments except those numbered 4 and 5, the carbonic acid was collected during five minutes at the periods recorded immediately under the heading, whilst in Nos. 4 and 5 the whole of the carbonic acid evolved was collected by several series of apparatus and weighed at the periods mentioned in the same place.

The thick perpendicular lines separate each set of experiments, whilst the faint lines separate each experiment in each series, and in No. 6 the shorter thick lines are placed between the records of the effect of each of the several doses of tea which together formed the whole experiment. The duration of each series varied from one to two hours, a period sufficient to show the maximum effect, whilst the interval between the commencement of one experiment and the beginning of the succeeding one was about 15 minutes, and the number of observations was six or seven in each series.

The horizontal series of lines upon the diagram are divided into the four sets above mentioned, viz., the carbonic acid, the depth of inspiration, the quantity of air inspired, and the pulsation. In each of these there is a thicker line, which is called the basis line because it indicates the amount which was recorded immediately before the food was taken, and the effect of the substances being greater or less than the basis is represented by the series of curves, (each one or two lines representing one or two persons experimented upon) above or below these basal lines. The amount constituting each basis differed with each person and with each experiment, and hence the curves show the increase and decrease and not the actual quantities, but in order that the actual quantities may be ascertained, the basis quantities are inserted in the diagrams at each basis line, the letter S. signifying Dr. Smith, and referring to the small dotted lines; M. signifying Mr. Moul, and referring to the plain lines; and F. M. signifying Mr. Frederick Moul, and referring to the larger dotted lines.

The figures on the scale attached to the left side of the diagram will enable the reader to measure the amount represented by the curves.

By way of illustration I will give a detail of the 3rd series of experiments. It consisted of an inquiry into the effect of 100 grains of black tea, on April 2, in the morning, with a temperature of the air of 51 deg. and 53.5 deg. by the wet and dry bulb of the thermometer. There were six experiments; the first commenced at ten minutes, and the last at fifty minutes after the tea had been taken. The basis quantity of carbonic acid evolved by Dr. Smith was 8.33 grains, and by Mr. Moul 7.98 grains per minute, and there was a maximum increase of 1.72 grains per minute by the former in fifty minutes, and of 1.3 grains per minute by the latter in one hour and eleven minutes after the tea had been taken. The amounts of increase given at each experiment may be in like manner found, as may also the increase in the other three subjects of inquiry recorded below the curves of the carbonic acid.

It will be observed that there is an increase recorded in each of these subjects of inquiry in almost every experiment, as may be seen at a glance by carrying the eye along each basal line.

DISCUSSION.

Mr. W. J. BLAND congratulated the meeting that the very excellent paper they had listened to had not been marred by what he considered the too common practice in the present day of scientific men,—the dwelling upon the exception and not the rule, for they had heard very little that evening on the subject of the adulteration of tea. The article valonia had, however, been mentioned in the paper. He thought it would be an iniquity to use such an article as an adulterant of tea, because the effect of it upon the system was so very different from that produced by tea. As far as his own experience in the tea trade went, he had never known valonia to be

used. He had seen a preparation of that substance, and having tested its qualities, he would feign hope that the use of it, as mentioned in a previous discussion upon this subject, was only a solitary instance. Dr. Smith had alluded, in the early part of his paper, to the non-nutritive qualities of tea. He (Mr. Bland) would be sorry if it were other than non-nutritive. The essential value of tea to us, as Englishmen, consisted in the absence of nutritive qualities. We were, perhaps, the heaviest livers on the face of the earth, and we stood in need of something to modify and qualify our food, and he was pleased to hear it stated in the latter portion of the paper that after a full meal, tea, taken after a proper interval, acted as an aid to the digestion of the food. Allusion had been made to the taste of the English people with regard to green teas, and it was said, although he thought the statement was hardly borne out by fact, that the Americans wisely chose the large-leaved green teas and rejected the small-leaved samples, leaving the English dealers to pay the higher price which those samples commanded. The first that was ever heard of young hyson—one of the finest and smallest qualities of green tea—was when some of it was taken in an American prize. It had been a favourite article ever since, and the Americans were as much attached to it as ourselves. After the establishment of the East India Company, the tea, which was first supplied from China, was the quality called Singlo, and nine-tenths of the tea supplied—not merely in the earlier years of the existence of the Company, but as late as the years 1810 or 1815—was of that quality; and he would take this opportunity of remarking that the purity of the teas, both green and black, exceeded in a great degree in the present day that which they obtained under the *régime* of monopoly. There was a growing intelligence amongst the dealers resident in China as well as those in England, which, he believed, went very far to protect the public against such a system of alleged imposition as they had heard so much of lately. He felt much indebted to Dr. Smith for the way in which he had dealt with this subject, for he (Mr. Bland) was always willing to be a learner upon this matter, and this paper would always be remembered by him as long as tea continued to be, as it was to him, a subject of the greatest interest.

Mr. MALONE said, having taken part in the previous discussions upon the subject, he might be allowed to express the interest he felt in the paper which had brought them together that evening. The public were greatly indebted to the Society for having taken up this important subject, and to Dr. Edward Smith for the experimental manner in which he had treated it, and they might now calculate upon the question being fairly ventilated. His (Mr. Malone's) experience went fully to confirm the statements contained in the paper. He thought the experiments brought before them were conclusive as far as they went, but it appeared to him that if they were to be really practically useful they must be much extended, and that the results of the action of tea upon the human system should be shown not only in the case of individuals in perfect health, but also in those who were in a state between health and disease. At one time he entertained the idea that tea assisted in the digestion of food after a hearty dinner, taken as an adjunct to the principal meal of the day, and, to a certain extent, he found it had the effect in that respect which was ordinarily produced by drinking milk or alcohol of considerable strength diluted with water; but ultimately he found it had an injurious effect upon the nervous system, and he had since come to the conclusion that in the case of some persons tea was highly injurious, and, therefore, instinct was not always a safe guide in such matters. With regard to the conflict between tea and alcohol, it was found in the experience of many persons that weak alcohol had a better influence upon the system as a beverage than tea; but experience would differ very widely. He did not think the time had come when they could universally recommend tea in preference to alcohol. They had heard a good deal about

the universal use of tea in China; but he could state that during the last year the reapers in Kent took alcohol in water in preference to beer, on account of the sour condition of the latter in the neighbourhood, and taking weak alcohol and water had no bad effect upon them. He thought in dealing with the broad question of recommending to the working classes one beverage in substitution for another, great delicacy and caution were required. For his own part he doubted whether moderately strong beer, made from good malt and hops, was at all inferior to tea as a beverage, but they required more complete experiments before they could come to a decision upon the question. With regard to the method of preparing tea for drinking, it would seem that the use of carbonate of soda was a wide departure from the custom adopted in China. There it appeared the infusion was made with water just boiled. All hard water contained lime and other substances, which were held in solution by carbonic acid, and in order to avoid precipitating them, the Chinese did not continue the boiling of the water, but if carbonate of soda were used, it precipitated the lime, and he was not sure whether it was a good thing to do so, inasmuch as the tannin was capable of uniting with the lime, and thus the beverage became more wholesome and less astringent.

Mr. Moul understood the last speaker to complain of the effects of tea drunk as a beverage at dinner. He believed the beneficial effects of tea were experienced when it was taken at a proper time after a heavy meal. One thing was important to be considered. It was possibly the case that in England the tea was generally drunk too hot, and the large amount of hot water might account for disturbances of the system which were attributed solely to the tea; in addition to which, the ordinary concomitants of tea—such as milk and sugar—might have something to do with the effects complained of by the last speaker. They, however, had the fact before them, that tea was the universal beverage of two-thirds of the human race, and, therefore, he thought they were not in a position to ignore its beneficial properties. It was a subject worthy of investigation, and he felt much indebted to Dr. Smith for his able paper upon it. Whether consumed in the palaces of the rich or in the cottages of the poor—whether administered by the bedside of the suffering patient or to the traveller after a day of fatigue—tea must be regarded as an article which was largely mixed up with the social and domestic economy of the country, and, therefore, he considered that the attention of the public, as well as of scientific men, could not be too largely directed to it.

Mr. REYNOLDS congratulated the meeting that they had had a most able and interesting paper upon an important subject, with but little or no allusion to adulteration.

Dr. CARPENTER, F.R.S., would express, on the part of physiologists, their thanks to Dr. Smith for the persevering and painstaking manner in which he had endeavoured to elucidate this subject. It was known to men of science that for many years past Dr. Smith had, with indomitable perseverance and strength of will, made a series of experiments upon himself and other individuals as to the influence of various conditions of food, exercise, and many other circumstances on what might be called the statics of the body, which would, he had no doubt, in the end issue in presenting them with some valuable and satisfactory results. At present, to his own mind, many of those results were, so to speak, tentative, and were valuable only as far as they went, but did not fully elucidate the subject. In any inquiry of this kind it took a long time to ascertain what the particular method of experimenting adopted would really bring out, and where it would fail. It was found, in the case of such investigators as Professor Tyndall and Dr. Pavy, that most of their early experiments merely formed the ground-work for ultimate research, and that a vast deal of time and labour was bestowed in arriving at the point from which the investigation might fairly be considered to start. He did not say that Dr. Smith's experiments, brought before them that

evening, answered that description, but they did not elucidate the whole subject. He would address himself to one point in particular. Dr. Smith had said scarcely anything upon what he (Dr. Carpenter) thought was one of the most important attributes of tea, viz., the specific effect of it upon the nervous system. He believed tea had a most decided effect upon the nervous system. It might be difficult to prove this, because it could not be proved by experiments upon respiration, or the measurement of the amount of urea, but they very frequently gained light with regard to the *modus operandi* of particular subjects from exceptional cases which now and then occurred. Such instances were to be found in the medical publications of the day with regard to the effects of tea in individual cases. A medical man, in investigating the habits of a patient, might attribute certain symptoms to the use of tea. He might recommend that the use of tea should be discontinued, and the symptoms might disappear, and when a number of these cases were brought together, they might have reason to believe that tea was the cause of the perturbed action of the system which these cases exhibited. With regard to the effect of tea on the digestion, he might observe that when the principal meal of the day—dinner—had been taken, and the system was charged with what was for the time an excess of food, the individual was less disposed for active mental or physical exertion. His own experience was that a cup of tea, moderately strong, taken two or three hours after a full meal, had a wonderfully clearing influence upon the mind, so that persons of studious habits generally preferred the evening, after tea, for any very great mental effort which they wished to make. He did not think it was a good habit, but persons felt the quiet they could command in the evening, that they could better concentrate the attention, especially when the brains had been "cleared" by a good cup of tea. He admitted the force of what Dr. Smith had placed before them, with regard to tea helping the blood to unload itself of the matter of which it needed to be relieved; but there was something more than this. There was the fact of the influence of tea—especially of green tea—in inducing wakefulness. Now, he believed this was generally the result of the increased activity of the mind induced by tea. When persons were restless, not arising from a feverish condition, but from a state of excessive mental activity, they had a parallel state to that which was induced by the operation of tea, especially green tea. The effect of a cup of green tea upon himself, when taken an hour or two previous to his ordinary bed time, would be to produce extreme wakefulness. He therefore felt that there was something in the peculiarly stimulating effect of tea upon the nervous system besides the influence upon the physical condition of the body which Dr. Smith had spoken of. He knew it was the habit of persons engaged upon the morning newspapers to perform a great deal of their arduous literary labour under the stimulus of strong green tea. He would add, that from black tea he had not experienced the degree of wakefulness he had alluded to, but in the case of green tea the effects were of the most marked description. He believed Dr. Smith had not adverted to a fact which had been brought out very strongly by Mr. Fortune, viz., the chemical changes that were effected in the green tea by the high temperature employed in preparing the leaf. Dr. Carpenter proceeded to mention a peculiar case which had come under his own knowledge, in which a friend of his resorted to green tea as a narcotic, finding that an infusion of one teaspoonful of it invariably in his case produced sleep. Thus it would be seen that the effects of tea upon different individuals were of the most anomalous character, and were such as to baffle the most careful researches into the subject. He had brought forward these views not for the purpose of disputing any of the results which Dr. Smith had advanced as matters of fact. He believed the tables before them contained very important facts, and he would express the high satisfaction he felt in seeing his

friend in such robust health, notwithstanding the experiments he had practised upon himself; and he could only express a sincere hope that his fate would not be that of Dr. Stark, who killed himself in trying the experiment of living upon cheese alone. He would call attention to one or two facts that were elicited by the investigations of a Commission appointed by the Admiralty about eight years ago with regard to the use of spirits in the navy. The practice in the navy was at that time to have two daily servings of grog, but the experiment of introducing tea into the navy was tried, and the evidence given before the Committee went to prove that the men to whom the choice was given generally preferred tea to the evening allowance of grog, and eventually that serving was discontinued in favour of tea, to the general satisfaction of the crews. He would also add that it had been stated by Sir John Richardson, who accompanied the first overland Arctic expedition under the late Sir John Franklin, that under the trying circumstances of such a climate, the men derived greater benefit from the more lasting heat produced in the system by tea than from spirits.

Dr. LANKESTER, F.R.S., wished merely to state that he thought the experiments of Dr. Smith upon the action of tea exceedingly interesting, and he could not for a moment dispute the facts brought forward; at the same time, he felt that Dr. Smith took these facts as to the action of food upon the respiratory processes, as the basis of his reasoning, in too wide a sense. With regard to tea, for instance, he thought Dr. Smith threw over very precipitately the experiments of Böker and others, which indicated that tea had the power of preserving the tissues of the body from waste. He thought its action in this respect was not so much to increase the respiratory powers or facilitate the excretion of carbonic acid gas from the lungs, but that its operation was rather like that of a poker, which, by admitting a larger supply of oxygen, caused a larger quantity of carbonic acid gas to come out of the chimney. He must say he thought Dr. Smith had not proved that the action of tea was altogether that of facilitating and hastening the waste of the body, and that, therefore, they must be careful how they adopted the tea drinking system on that ground. Their fat friends might drink tea and find themselves fatter than ever, and lay all the blame upon Dr. Smith. There was another question with regard to the volatile oil, the theine and the tannin. It was the fact that tea contained 25 per cent. of tannin, and he did not think Dr. Smith had alluded to the effect of tannic acid upon the system. That was a most important agent in the action of tea. He thought the action of tannic acid after a full meal was injurious, as was shown by taking a heavy breakfast with a large quantity of tea, and also by the effects of tea taken very shortly after dinner. He attributed them not so much to the volatile oil and theine as to the tannic acid. He did not know how far tannic acid had to do with the facts recorded in the tables, but he could say, in taking a good size cup of strong tea that a person would imbibe about five grains of tannic acid. Theine was also proved to have an action on the nerves. Mr. Cogswell had made some experiments which showed that half a grain of theine would kill a frog, and if that were the case, they must expect it to have some effect upon the nervous system of the human frame. The volatile oils of tea were matters for further inquiry and study. The difference of action of black and green teas was very remarkable, and what the volatile oils were which they contained was at present very little known—how far they were acted upon by the process of preparation of the tea, and how far they differed in different varieties of the tea plant. Besides all this, from what they had recently heard as to the extent to which tea was alleged to be adulterated, they could not tell whether Dr. Smith's experiments had been tried with a perfectly unadulterated article. He thought they were much indebted to Dr. Smith for the persecution of himself from day to day in making

these experiments. They would remain as facts to be discussed and perhaps disputed by some for years to come; and he merely threw out these hints, differing from some of the conclusions. He believed no more important thing could occupy the human mind than the subject of the laws which regulated the substances which we daily took as our food—the laws in fact which regulated our life. It became of the greatest importance that men should secure healthy and strong life, and it was only by attending to these things that they could hope to attain this.

Mr. W. J. BLAND believed that the different effects upon the system of green tea and black arose entirely from the method in which each description was prepared by the Chinese—the green tea being thrown into the pans directly after it was picked, and sometimes with the dew upon it, much of the volatile oil and theine was dissipated and thrown off by the heat. Those properties were retained to a greater extent in the black teas by the fermentation to which they were subjected.

Dr. EDWARD SMITH, in replying upon the discussion, said he was gratified by the manner in which the paper had been received and by the good discussion which had taken place upon it. If he had any regret it was that his friend Dr. Lankester was not present during the reading of the paper; for he would then have found that allusion had been made to tannic acid, to the effect that although there was 25 per cent. of that substance in tea, yet the boiling water took up only 16 per cent. of the properties of the tea altogether; and therefore he thought the statement of Dr. Lankester that a moderate-sized cup of strong tea contained five grains of tannic acid could hardly be supported. Dr. Lankester had, he thought, done him a little injustice by making it appear that he had based his observations upon experiments with regard to the respiratory organs solely. Upon this he would appeal to the earlier portion of the paper, in which he stated the amount of nitrogen that was passed off, and gave his reasons for dissenting from some of the conclusions arrived at by previous experimentalists. Both in reference to alcohol and tea he had made it a point to consider the nitrogenous condition as well as the respiratory condition. He regretted that his allusions to the experiments of Böker did not meet with Dr. Lankester's approval. He had stated his reasons for dissenting from those conclusions. He thought there were sufficient grounds for believing that when tea was mixed with other articles of food the effects were very different from those of tea taken without any other admixture whatever. From that he concluded there must be some error in Böker's experiments. With regard to the suggestion that the teas with which he had experimented might possibly be adulterated, he could only state that he received them from Mr. Moul, who was a tea-broker in the City, and he had every reason to believe the tea was as pure as could possibly be obtained. He quite concurred in the remarks that had been made as to the injurious effects of valonia upon the stomach, and the undesirableness of taking tea with a hearty meal. As to the operation of tea upon the nervous system, not only did it stimulate the respiratory action, but it increased the amount respired. It had an action through the nervous system upon the muscular parts of the body; and that it acted also upon the mind was most clear. Of course, he could not, in his paper, attempt the solution of the entire question. He, however, hoped he had done something in that direction, and that they would accept what he had done. He only hoped some other gentleman would take up the points that were wanting, and supply all his deficiencies.

The CHAIRMAN was sure the meeting would agree that the Society was deserving the thanks of the community at large for having been the means of bringing subjects of the greatest importance to the health and prosperity of the public thus prominently before them, and affording these opportunities for their open and fair discussion. He would say of his friend Dr. Edward Smith, that there was no one in the profession who had been more indefatigable or was more

deserving of praise than he was, for the manner in which he had investigated numerous subjects connected with the social and domestic condition of the community, and they were highly indebted to him for his paper on this occasion. His own personal experience and observation confirmed the results of Dr. Smith's researches. There were several topics which were worthy of discussion, but at that late hour he could scarcely even point them out. He might, however, remark that the comparative merits of green tea and black tea deserved closer observation, and the manner of preparing tea was likewise a subject of the greatest importance. It was evident that we had very widely departed from the lessons on tea-drinking which were derived from the Chinese, inasmuch as in this country we mixed with it other articles of food which, he believed, impaired the operation of tea upon the animal economy. He believed, in order to judge properly of the merits of tea, they ought to use it in the way it had been used from time immemorial by the Chinese themselves, viz., as a weak infusion, without sugar and milk, taken in moderate quantities, and at a proper temperature. Then, again, it should only be taken at a certain period after a full meal. Its operation upon the system was restorative, and to a certain extent stimulating, but totally unlike the stimulus produced by alcohol. He believed a great deal of the ill-effects of tea upon some persons, in producing flatulency and acidity of the stomach, were occasioned, in a great measure, by the addition of milk and sugar. It was from that cause he believed that so many persons complained of the effects of tea. He might add that he considered his friend Dr. Smith had admirably illustrated the subject as far as he had gone. The time to which he was necessarily limited prevented him entering upon a variety of topics which he might otherwise have touched upon. He was sure the meeting would cordially join in a vote of thanks to Dr. Edward Smith, and would by that means encourage him to proceed with his investigations into these subjects in which they were all interested.

A vote of thanks was passed to Dr. Edward Smith.

The Paper was illustrated by a series of specimens of the finest descriptions of tea, kindly contributed by Mr. Moul.

The Secretary announced that on Wednesday evening next, the 20th inst., a paper "On the Alpaca, and its Introduction into Australia," would be read.

THE PENNY READING MOVEMENT.

On the occasion of the last reading of the winter season being given at the Lecture-hall, Tower-street, Ipswich (Friday, the 21st December), an address, signed by the joint managers, Mr. T. S. Gowing and Mr. Charles Sulley, was read by the former gentleman. The following are extracts:—

"This being the closing night of the third series of the Ipswich Penny Readings, the managers avail themselves of the opportunity of taking a brief review of a movement, which, originating in Ipswich, has now spread far and wide, and been crowned everywhere with success.

"It is true, that the winter before the Ipswich Readings began, a Public Reading Society had been started in London, with the venerable Lord Brougham at its head, and having for its honorary secretary, the able, indefatigable, and influential barrister, Mr. C. J. Plumptre; but so little had this society progressed, that in 13 meetings in London, on an average only 100 persons attended each meeting, and the expenses had to be defrayed by subscription.

"It was not till notices of the first report of the Ipswich Penny Readings appeared in the *Builder* and in various newspapers, and a full abstract was inserted in the *Journal*

of the *Society of Arts*, which circulates amongst all the institutions of the country, that public attention was thoroughly aroused.

"At the annual conference of Institutions, held at the rooms of the *Society of Arts*, in July last, Mr. Gowing introduced the subject of these readings, when the following resolution was unanimously adopted, 'That it is desirable to establish readings in connection with the Institutions in union with this Society.' At the great Educational Meeting, at Warminster, last October, the Hon. and Rev. S. Best read a paper* on the Ipswich Penny Readings, from materials furnished by Mr. Gowing, as did also the Rev. Mr. Bartlett, of Wimbledon.

"These various notices produced for one of the managers, Mr. Gowing, a large crop of communications, not only from the parts adjacent, but also from widely scattered places in every part of England, and entailed on that gentleman an amount of correspondence in reply, which only the desire of furthering the movement could have induced him to undertake.

"Mr. Sulley, on the other hand, has been spreading a knowledge of the plans, and giving practical illustrations of the way they are to be worked out in many of the leading towns in Suffolk and Essex, and that with a degree of success which is always producing fresh applications for his personal services.

"The managers desire to remark here how much they feel indebted to the Elocution Class of this Institution, not only as furnishing some of the experience on which the Penny Reading scheme received its practical development, but as a means by which the readings themselves have been rendered additionally interesting. They have reason to believe that the appearance of some of the young members has been a source of gratification to the audiences in this hall, while it has re-acted favourably in the class itself, by exciting honourable emulation among the members. Deputations of readers from the Elocution Class have also visited several of the neighbouring towns and villages, where their readings have been considered very attractive to numerous and attentive auditories.

"It is also but a bare act of justice to the readers to state, that in addition to the difficulty of selecting pieces, some time and trouble has to be bestowed in studying them, so as to bring out their characteristic points; for no piece, however interesting, can be read in public without much consideration. Besides this, there are few historical or narrative selections that do not require judicious curtailment, and this cannot be effected without very careful and repeated perusals. Oftentimes a piece which would be absolutely wearisome if read in full, becomes in this way a very interesting narrative or tale.

"A few words as to the general character of the readings. They are not intended to be sermons, or moral essays, or scientific disquisitions—but simply means of rational recreation. To make them attractive a certain infusion of the humorous and comic element seems to be indispensable.

"In conclusion, the managers desire to repeat once again, that the main feature which has insured success to the readings has been the furnishing of a variety of readers and readings on the same evening. This is their distinctive characteristic; and when, as in some instances round about, one or two individuals have supposed themselves capable of supplying all that was needed, failure instead of success has been the ultimate result."

EXTRACTS FROM THE REPORTS OF H.B.M. CONSULS.

(Continued from page 131.)

PERNAMBUCO.—In the northern part of the consulate of Pernambuco have been discovered gold, iron jet, nitrate of potash, carbonate of soda, alum, copperas, plumbago, and amber. It is expected that coal will also be found.

* See *Journal*, Vol. viii., p. 826.

The principal articles of export from the five provinces are sugar, cotton, hides, rum, rice, farinha, tobacco, and many other tropical productions, but in such small quantities that the exportation may fairly be said to be confined to sugar, cotton, and hides. The amount of sugar exported averages betwixt 60,000 and 70,000 tons annually; of cotton, about 17,000,000 lbs.; and of hides, about 500,000.

BAIZE or coarse oollen cloth, dyed blue, is extensively manufactured in the Equator. A great part of it is exported by land to New Granada, and used by the miners of the coast of Choco and Barbadoes.

ICELAND COD FISHERIES.—Upwards of one hundred small vessels, employing about 1,200 or 1,500 men, are annually fitted out at Dunkirk for these fisheries, the value of the produce of which is estimated from £120,000 to £160,000. It is principally used for home consumption, and Paris is the chief mart. What is unsold at the approach of a new fishing season, is dried and shipped to the colonies—and also the Portuguese ports, the French Government according a premium of from 12 to 20 francs per 100 kilos, the amount varying according to destination.

SOAP.—Soap is the oldest and one of the most important of the manufactures of Marseilles. This may be ascribed to the position of the town in the midst of the countries producing olive oil. Until of late years, this oil was almost the only one used in the making of soap; but the introduction of seed oils, tallow, hogslard, olive, palm and cocoa-nut oils, which are now so much used, has had the effect of increasing the number of manufactories elsewhere so considerably as to constitute a formidable opposition to those of Marseilles. Accordingly, this manufacture is not progressing; still, Marseilles being the chief mart for olive oil and oleaginous seeds, it does not retrograde. The number of soap manufactories at work in 1855 was 44, employing about 900 workmen. The usual production is about 65,000 tons, absorbing 40,000 tons of oil, whereof 2-3rds is seed and 1-3rd olive oil. The other oily substances are but little used in the Marseilles manufacture.

CRUSHING-MILLS FOR OLEAGINOUS SEEDS.—This manufacture is of recent introduction at Marseilles, being only of about 20 years standing. It originated with the use of seed oil in the manufacture of soap. The first seed-oil employed by soap-boilers was that produced from oillette, grown in the northern departments of France; but, as soon as it was discovered that linseed, sesame seed, and ground nuts, might be substituted, crushing-mills were set up, and in 1855 had attained to the number of 20, turning 425 presses, and employing 1,000 workmen. Besides being used for the making of soap, seed-oils are also in considerable demand for lamps, machinery, and for various other uses; and they now constitute one of the most important manufactures of Marseilles. The following figures represent the quantity of seed oils produced in this city in 1855; the quantity of seed received from Russia in that year was small, compared with that usually furnished *via* the Black Sea:—

	Tons.
White Sesame oil	8,000
Indian and African Sesame ditto	6,000
Ground Nut ditto	7,328
Linseed ditto	3,878
Poppy ditto	100
Palm ditto	383
Cotton Seed	697
	<hr/> 26,386

MANUFACTURE OF SODA AND OTHER CHEMICAL PREPARATIONS FROM SEA SALT.—Although this manufacture has been excluded from the town of Marseilles, owing to its insalubrity, it must still be regarded as a Marseilles manufacture, for it is worked by the people of the town, and the greater part of its produce is used in the soap manufactories of the city. The number of soda manufactories

is 17, of which ten are in operation. Their principal productions are: 1st.—25,000 tons of carbonate of soda, known in trade by the name of "Soude factice." 2ndly.—10,000 tons of salt of soda. These works produce also sulphate of soda, sulphuric acid, chloride of lime, and other products derived from the chemical combinations of sulphur and sea salt.

SALT WORKS.—They are at Carry, Ponteau, Bone, Martigues, Berre, Le Val-duc, Fos, Laroque, and Camargue, places along the coast. These works supply Marseilles with salt, and furnish large quantities for exportation. The number of these works in operation is 19; they employ about 500 workmen, and produce annually about 110,000 tons of salt.

CORAL MANUFACTURE.—This manufacture, though long established at Marseilles, has not progressed. The town has three establishments, employing 400 workpeople, and giving an annual return of about £60,000. The reason that this manufacture does not advance is the insufficiency of the coral fishery in the Mediterranean.

ARTIFICIAL PRODUCTION OF ICE.

In a recent number of "Cosmos" the article by Rear-Admiral Sir Charles Elliott,* "On the Preservation of Food," in which he refers to Harrison's apparatus for producing ice, by means of the evaporation and condensation of ether, is noticed. A description is also given of an ice-producing machine invented by M. Carré, in which ammoniacal gas is used, its great feature being that its action is continuous instead of intermittent. The principal parts are—a boiler heated on an open fire, or by steam; a vessel placed above the boiler for the purification of the gas; a tubular condenser, where the gas is liquefied by the action of a current of cold water; a refrigerator of a suitable shape, into which the liquefied gas regularly passes; a vessel into which the gas escapes from the refrigerator, where it is absorbed by water like steam in a condenser, with this difference—that in this apparatus the water must be kept constantly cooled by a current of cold water flowing through a worm, carrying off the latent caloric disengaged by the absorption; a pump which brings back again into the boiler the water which has been saturated with gas; and, finally, a regenerator, in which the water which is to be used for absorption exchanges its temperature with that of the water saturated with gas. The object of the boiler is similar to that of a distilling apparatus, and the separation of the ammoniacal gas from the water is easily effected, as it is not necessary that the water should be entirely exhausted of its gas, since it never entirely leaves the apparatus.

It is, therefore, unnecessary to multiply arrangements for effecting this object. The purification of the gas in the receiver, where the solution arrives at the maximum of concentration, is sufficiently perfect to give good results. The liquefaction of the gas, which is always a little watery, is effected under a pressure of six to seven atmospheres, at a temperature of 25 deg. centigrade. The absorption of the gas by the water is accompanied by a considerable disengagement of caloric, which is equivalent to the cold produced by the caloric absorbed in the refrigerator. The absorption would be impossible at the necessary rate if the solution were not kept constantly cooled by the passing of cold water through the worm arranged in the interior of the vessel. The ammoniacal solution from the boiler is first deprived of the greater part of its gas, and when the apparatus is ready to begin the work of refrigeration, it is already much weakened, more especially towards the bottom of the vessel; but as it still contains a considerable quantity of ammonia, and that there would be besides a greater loss in allowing it to run out hot, it becomes important to render it fit for absorption by exchanging its temperature with that of the saturated water which returns to the boiler.

* See present Vol. of *Journal*, p. 95.

The intensity of the cold that may be produced with this apparatus varies within wide limits, and is determined by the quantity of gas with which the water is charged in the absorbing vessel; the more rapidly it enters this, the more energetic will be the absorption, and the more intense the cold; by only making it absorb 15 to 20 per cent., the cold will easily reach to — 50 or — 60 deg. centigrade. The water carried off in the form of steam, with the ammoniacal gas, would tend to accumulate in the refrigerator and paralyse its action, but an intermittent or continuous removal of it, with the exchange of temperature between the liquid going out and the liquid coming in, obviates this inconvenience. The exchange of temperature is also effected between the gas which passes very cold from the refrigerator and the liquid which re-enters it at 20 or 25 deg. centigrade. These exchanges are easily arranged by making one of the two conducting pipes wind round the other.

Home Correspondence.

ADULTERATION OF TEA.

SIR,—I beg to hand you the minutes of a meeting held at Canton, in April, 1860, relative to the adulteration of tea, (with correspondence on the subject), upon which the extraordinary statements lately put forward appear to have been erroneously based.

These minutes show that an attempt being made (or perhaps it would be more proper to say being about to be made) to introduce a spurious article into the market at Canton, the leading houses there, whose names are appended to the minutes, at once took the most prompt and decisive measures to nip the fraud in the bud.

I think you will deem it but justice to insert in your forthcoming number of the *Journal* these minutes, which I think myself most fortunate in having obtained from the eminent firm of Peek, Brothers, and Co.

From a practical acquaintance of many years with tea and the tea trade, I will undertake to say, not that seven-eighths are not adulterated merely, but that not one-thousandth part of the tea supply of this country is adulterated.

The wide difference of the two statements is of course startling, but the former one as to the large amount of adulteration originated purely in an error, which I believe the gentleman who made the statement is anxious to have corrected.

I am, &c.,

H. C. WHITE.

The following are the minutes referred to :—

Minutes of a Public Meeting of British Merchants, held at Canton, on the 18th April, 1860, for the purpose of devising the best means for putting a stop to the adulteration of Canton made Teas, and the correspondence with H. B. M.'s Consul, together with the Nanhac Magistrates' proclamation with reference thereto.

RESOLUTIONS.

"In consequence of its having been discovered that a large quantity of false leaf has been purchased, and is now in preparation for mixing with the new Tayshan and other Canton Teas as they come down, this meeting deem it most desirable to do all in their power to prevent its use; they therefore beg to report the fact to H. B. M.'s Consul, and suggest that it would be most advisable to represent the matter to the Nanhac or other officer, in order that he may issue a proclamation (to be posted in various parts of the City of Canton, at Honam and in the Canton Tea districts) stating that in every case proved against the manufacturers or teamen of using this spurious leaf or any spurious article, in however small a quantity, they will be punished by fine and exposure—and that the broker or brokers offering such spurious matter for sale be held responsible, failing to declare his or their principal."

II. "That a committee be formed to communicate with H. M.'s Consul, and generally to carry out the objects of this meeting."

(A Committee was formed.)

Canton, 24th April, 1860.

The Committee appointed to communicate with H. B. M.'s Consul with reference to the Adulteration of Canton Teas, beg to report to the members of the meeting held on the 18th inst., that H. M.'s Consul highly approves of the resolution then passed, and is willing to render his hearty co-operation in the matter,—upon the condition, that this community pledges itself to support him in carrying out the intention of the said resolution by refusing to purchase knowingly any adulterated tea.

The accompanying letter, addressed to H. B. M.'s Consul giving this guarantee, is herewith circulated for signature by the respective firms.

Canton, 24th April, 1860.

SIR,—The Committee appointed at a public meeting held on the 18th inst. to wait upon you with reference to the Adulteration of Canton Teas, having reported that they have had the honour of laying the subject before you, and that you highly approve of the resolution then passed, and are willing to render your hearty co-operation in the matter, upon the condition that the community pledges itself to support you in carrying it out by refusing to purchase any adulterated tea, we the undersigned hereby agree to give you every support in endeavouring to check the practice and put a stop to the system of adulteration by refusing to purchase any false or lie tea.

We have, &c.,

JARDINE, MATHESON, and Co.
DENT and Co.
GILMAN and Co.
BIRLEY and Co.
REISS and Co.
GIFFORD and Co.
HOLLIDAY WISE and Co.

MOUL and Co.
LINDSAY and Co.
SMITH KENNEDY and Co.
JOHNSON and Co.
J. C. COUTTS.
D. W. MACKENZIE and Co.

C. A. Winchester, Esq., H.B.M.'s Consul, Canton.

British Consulate, Canton, 15th May, 1860.

GENTLEMEN,—I have the honour to acknowledge receipt of your communication relative to the adulteration of tea; and it will give me much satisfaction if the despatch which I propose to address to the Nanhac District Magistrate on the matter should assist in the attainment of your object.

So long as there are foreigners willing, in the hope of profit, to purchase adulterated teas, an entire success can scarcely be looked for. At all events the steps taken will facilitate the protection of the purchaser of genuine teas from the fraudulent introduction of the spurious admixture.

I have the honour to be, Gentlemen,

Your most obedient servant,

CHARLES A. WINCHESTER.

Messrs. Jardine, Matheson and Co., and Others.

British Consulate, Canton, 25th May, 1860.

GENTLEMEN,—I have to enclose for your information copies of the correspondence of this office with the Nanhac, relative to the adulteration of teas, and of the special order issued to the teamen and others concerned in the trade.

The publication of this document, with the apprehension of proceedings to be based upon it, will, I trust, suffice to protect your interests from fraudulent loss. It will be desirable on your part to direct that more than ordinary care should be used in turning out and examining teas; at the time the general muster is taken that one or more canisters should be sealed both by the tea inspector and broker for reference; and, in event of the tea being discovered at the end of the voyage to be, in spite of these precautions, adulterated, that the brokers in England should be directed to return to China a sealed muster duly authenticated by declaration made in presence of a magistrate.

The circumstances connected with this correspondence lead me to hope that a steady and combined determination to refrain from the purchase of adulterated produce will secure a fair supply of genuine leaf being brought into the market.

At the time your letter was handed to me the Chinese names of three plants used for adulteration were sent to me. Fresh specimens of the leaves were afterwards obtained. The principal, *Lo ti sung kun*, is the *Gynura auriculata*, a recognized drug, largely dried and used by the Chinese in the form of an infusion, which is stimulant and slightly acrid. The second, *Ardisia erioapa*, is innocuous; while the leaves brought—as representing the third—proved to be those of a common species of mint.

I have the honour to be Gentlemen,

Your most obedient servant,

CHARLES A. WINCHESTER.

Messrs. Jardine, Matheson, and Co., and Others.

Enclosure 1.

MR. ACTING CONSUL WINCHESTER TO THE MAGISTRATE OF NANHAE.

Canton, 15th May, 1860.

I have now received from the majority of the English merchants a petition, in which they say that lately a great deal of the tea in this locality has been adulterated with other leaves; and that though they would not knowingly purchase such adulterated tea, they fear that it may hereafter be delivered to them for tea that they may purchase from musters of genuine tea, and that heavy loss may thus be entailed on them when the fraud is discovered on the examination of the tea at home. They therefore beg my intervention to get such practices put a stop to.

Now it is not only far from right that the tea-dealers should sell one thing and deliver another; but it is also hard to say that if adulteration be allowed, the adulterating substances may not sometimes be of a kind deleterious to health. I have therefore to request that you will summon the tea-brokers before you, and give them the strictest warnings on this subject; and issue a proclamation stating that any persons hereafter detected in such malpractices will not only have to make good any losses that they may have caused to the purchasers of the tea, but will in addition be criminally punished with the utmost severity.

Trusting that you will see the expediency, in a public point of view, of the course thus pointed out for calming the apprehensions of the merchants, and putting a stop to wrong doing,

I have &c.

Translated by
(Signed) W. H. PEDDER, Interpreter.
True Copy. WM. M. COOPER.

Enclosure 2.

THE NANHAE MAGISTRATE TO MR. ACTING-CONSUL WINCHESTER.

Canton, 21st May, 1860.

I am in receipt of your official communication, in which you say [here is quoted the acting Consul's letter to him of the 15th instant].

Receiving the foregoing I beg to inform you that I have given orders to ex Hong Merchant Woo E-ho, &c., &c., to make known to all tea-merchants and brokers that any persons selling adulterated teas as genuine will on discovery be liable to punishment, as well as for the reimbursement of any losses that may have been caused by such fraudulent act.

Translated by
(Signed) W. H. PEDDER, Interpreter.
True Copy. WM. M. COOPER.

CHOO, ACTING MAGISTRATE OF THE DISTRICT OF NANHAE GIVES INSTRUCTIONS FOR THE INFORMATION OF THE EX-HONG MERCHANT WOO E-HO, &c., &c.

I have now received from the English Consul the following official communication [here is quoted the Acting-Consul's letter].

Receiving this I have accordingly to issue orders, on the receipt of which you will make it known to all persons at Canton connected with the Tea trade that hereafter any one dealing in this article with foreign merchants must in every case pack teas for delivery of the exact kind and quality of the muster by which they were sold; and that such abuses as clandestine mixing up of spurious tea (with the genuine) will not be permitted. That if, after this declaration any tea merchant shall not conduct himself aright in these respects, he will, as soon as discovered or informed on, be certainly proceeded against for the damages and losses that may have been sustained, and visited with due punishment. And that none will then be able to say that they were not previously warned.

And you will be careful to impress the foregoing orders on the parties concerned, so that such shall understand them.

Pressing! Pressing! A Special Declaration!

Translated by
(Signed) W. H. PEDDER.
True Copy. WM. M. COOPER.

ADULTERATION OF FOOD.

SIR,—I intended to have made a few observations last night, respecting the able and interesting paper read by Mr. Wentworth Scott, but the great number of speakers

and the lateness of the hour prevented me from doing so. The discussion appears to me to have borne almost entirely on the tea question, which more properly appertained to last week's paper, whilst the real question at issue, viz., the adulteration of food in general and the means to prevent it, seemed to have been somewhat neglected. That this adulteration exists more or less, I think no one can deny, but the means to put a stop to it ought, I think, to have called forth more attention. As Mr. Scott observed, it is principally the poor man who suffers from the above; in the low and cheap neighbourhoods nearly all edibles and drinkables offered for sale are adulterated, for the sake of dishonest gain, or invidious competition. The fact is, that most things are offered at impossible prices, and such prices can only be maintained by selling trash. Now, what is to be done? No doubt Dr. Hassall's exposures in the *Lancet* have done some good, and Mr. Scott's paper will likewise produce beneficial results, but I am afraid neither of them will reach and enlighten the principal victims, the lower classes. And if they did, what are they to do, surrounded as they are with shops selling wares all equally bad, and having no means nor opportunities of supplying themselves at a better market. The only remedy I think practicable is, that Government should appoint a staff of active and efficient inspectors, whose duty would be to visit these shops, take samples of what they sell, have them examined, and punish with fine and even imprisonment those who are found guilty of retailing any articles adulterated with deleterious drugs. To this may be objected, that the tradesman may not be aware that he is selling anything injurious, but in that case, let him give up his authors, and it will soon reach the really guilty party. That is the system they adopt in France. There I have seen adulterated milk upset in the street by the inspectors, and sophisticated wine allowed to flow into the gutter; whilst here our milkmen are allowed to carry about their chalky abominations without fear of any prying glance, and our publicans may drug and poison us as they please.

Some will say that this is a free country, where people do not like to be interfered with; but I may reply, that in such a case liberty degenerates into licence, and that we have a right to expect from government the same protection against the man who poisons us slowly with his deleterious wares, as we would have against the assassin who murders us at one blow.

I am, &c.,
EUGENE RIMMEL.

96, Strand, 31st Jan., 1861.

SIR,—Not having had an opportunity last Wednesday of offering a few remarks on Mr. Scott's paper, "On the Adulteration of Food," I shall feel obliged by your giving publicity to the following lines in the *Journal*.

Undoubtedly a great service is done by chemists in tracing all possible adulterations, especially those hurtful to human life, and in making the public familiar with the sometimes very simple means of detecting these adulterations; but, productive and valuable as these endeavours are to protect and to improve public health, I think we cannot be too careful in drawing a proper and clear distinction between fraudulent adulteration and accidental impurity, or in denouncing as an adulteration any foreign matter brought to light by a single chemical reaction.

I cannot help thinking that in this regard Mr. Scott treated his subject in too light a manner, that he is too much inclined to take an exception as the rule; a remark which I am led to make in consequence of Mr. Scott's alarming statement of the adulteration of bread.

He states that sulphate of copper is used in Austria to improve the quality of bread, and that in London alum is used to the extent of 87 per cent. of bread.

But statements of such grave character should not go forward without the addition of a most substantial proof, or of the exact quantity of the adulterant found by careful analysis. All our works on technical chemistry invariably

tell us, under the article "bread," that in England alum is added to bread, and sulphate of copper on the continent. But is this really the case? On the occasion of Dr. Daughlish's paper the opinion was strongly expressed that the bakers did not use alum to the extent generally believed; and if my memory serves me right, it was then that Dr. Odling stated that out of 64 samples of bread, obtained from various shops in Whitechapel, not a single one was found to contain alum. Surely a striking difference between Whitechapel and Chelsea! In regard to the sulphate of copper, I must add, that when at Prague, about eight years ago, I tested a great many samples of bread for this poisonous substance, but not in a single instance did I detect a trace of it, and I also have the authority of one of the most respectable bakers at Vienna, a proprietor of one of the largest businesses, that this adulteration is utterly unknown in Austria. Everybody recollects the outcry and panic in 1852, that our bitter ale was adulterated with strychnine, and the results of professors Graham and Hofmann's subsequent examination of a variety of samples, showing how utterly unfounded was all fear on this account; and I believe that many articles, against the use of which we now are warned, would appear as free from adulteration as that beer was, if we made a just distinction between adulteration and accidental and harmless impurity.

I am, &c.,

FRED. VERSMANN, F.C.S.

Consulting and Analytical Chemist.

7, Bury's-court, St. Mary-axe, E.C., Feb. 6th, 1861.

SIR,—Up to the present moment I have purposely refrained from offering any reply to the protracted discussion upon my second paper on the above subject, wishing, first, to give an opportunity for others to record their opinions in the *Journal*.

I may now more appropriately make a few additional observations, as several letters in the last *Journal* show sufficiently that my results are not "exaggerated," but are, if anything, rather under the mark, as regards the extent to which adulteration is carried at the present time, and that, in the opinion of really competent authorities, the remedies which I have suggested, instead of being "of the most futile kind," would go a great way towards suppressing the evil, if carried out in an efficient and comprehensive manner.

To the very strongly expressed opinions of Mr. W. Hawes, which, under other circumstances, I might not notice, I am prepared to give respect and attention, as they are those of a member of the Council of the Society; but when it is deliberately stated that certain statements of mine are either "entirely false" or else are "gross misrepresentations," I am bound, in furtherance of one of the chief objects of the Society—the eliciting of truth—to deny such assertions in the most solemn and emphatic manner.

If Mr. Hawes, in place of resting his belief in a biassed and ill-founded idea, would take the trouble of purchasing 1,000 loaves of bread at as many different bakers in various parts of London, and of having the said loaves carefully examined, his opinion would speedily be changed, as fully one-fourth of the total number would be found repulsive to an ordinarily discriminating palate, while, after more accurate testing, more than the prescribed 870 loaves would afford evidence of being more or less adulterated or sophisticated in one way or another.

The peculiarity of the argument, which requires that a case of fraud perpetrated at the Wakefield cattle-market should be proved by bringing a sack of corn bought in Mark-lane into the meeting-room of the Society, is too plain to need any comment.

I must next protest against my being considered responsible for statements made by the author of the paper preceding mine, as implied by Mr. Hawes. So far from believing that seven-eighths of the tea, as imported into this country is adulterated, I distinctly said (*vide Journal*, page 159, col. 2) that of the black teas sold retail in

London, the total number of adulterated samples,—that is the Chinese and British adulterations put together—is about 61, and of the green teas 78, in each 100 specimens.

If, therefore, of the teas sold retail in this metropolis (according to my analytical results), much less than seven-eighths is found to be adulterated, it is evident that the article as imported, and before it has been tampered with by shopkeepers, must be adulterated in a still smaller proportion.

Contrary to the avowed opinion of Mr. Hawes, exaggeration is what I have all along specially endeavoured to avoid; the main facts are quite bad enough, without magnifying them, and consequently I have, throughout the Table showing the average per cent. of adulterated samples, made the figures representing the same rather lower than actual analytical researches exhibit, in order to be on the safe side.

If I had wished my paper to partake more of the marvellous and startling in its character, I could easily have narrated instances of adulteration "on the best authority," which would have seemed perhaps in some degree to warrant the severe criticisms of Mr. W. Hawes, but such was not my object, as I hold that all communications made to any Society whose objects are of that practical and extended nature which characterises the Society for the Encouragement of Arts, Manufactures, and Commerce, should give nothing as facts but what may fairly come under that denomination—should give hypotheses as hypotheses, for whatever they may happen to be worth—and should rigidly exclude everything like an undue straining at a dictatorial or semi-dramatic "effect," if calculated in the slightest degree to mislead the public or create a false impression.

Now, I have often been assured that horses' fat is used for adulterating butter, that the baked liver of various animals is employed to falsify coffee and chicory, &c.; but such tales I do not credit, for the simple reason that the supply of the adulterant would be far too limited. Of course, exceptional instances will now and then occur—a man dealing in articles of food may by chance come into possession of some waste product or other, which he may use while it lasts for an adulterant. Such, however, cannot be legitimately considered as a usual or ordinary species of adulteration. I have studiously omitted adulterants of such doubtful character in my paper, for the reasons given before.

The part of Mr. Hawes's speech, however, which has excited the greatest surprise is that which ridicules the idea of appointing a Committee from the Society itself on the adulteration of food and drink. To hear such an observation from anyone at all acquainted with the Society of Arts would astonish us greatly—but how much more so when that observation emanates from a member of the Council? The undoubted success and utility of many Committees of the Society is so well-known that it is quite needless to dilate upon the same, but taking the vitally-important subject of the purity of our daily food—that food upon which the physical strength of millions, the mental force of thousands, and the general health and comfort of all of our countrymen, depends—all other questions must instantly sink into comparative insignificance. If the opportunity is afforded me, I shall at another time have great pleasure in explaining in a detailed manner under what circumstances the Special Committee I have suggested should be appointed, and in what way it might be rendered really efficient—an honour to the Society and a benefit to the public. Meanwhile I content myself with respectfully but most earnestly urging the Council to give the question that grave consideration which the public at large, and I believe the bulk of the Society, expect them to accord, however large and (apparently) difficult may be the object to be accomplished, or however humble the forefinger that first points the way.

As to the public being able to "take care of itself" when I am told by anyone, not an inmate of Colney Hatch or other similar establishment, that the public can protect

itself against burglars and pickpockets without any police; that it can prevent forgeries and embezzlements without the assistance of the legislature; that it can keep in health without any aid from physicians; and the country could best prepare for invasion by disbanding its army and destroying the fleet; then, and not till then, can I or anyone believe that the public can protect itself against the universal system of adulteration now evident throughout the land, without the slightest help from the government or from science.

If I am right in believing that Mr. Malone is of opinion that tea and tobacco can be so ingeniously adulterated that detection is impossible, I beg here to record that I entirely disagree with that opinion.

Mr. R. Temple's remarks upon cayenne pepper I can fully corroborate.

Mr. Tufnell has rightly interpreted my motives in giving a few simple tests for adulterants for the public generally. From none of them (in inexperienced hands) should an adulterant be stated decidedly, in a court of justice, to be present; but from their general behaviour anyone may form an opinion as to whether he had better cause the article tested to be regularly analysed and proceed with the case or not. As water will not separate from a mixture of that fluid and milk, Dr. Wyld's "test" is either a typographical mistake, or is itself entirely erroneous in principle.

I am, &c.,

WENTWORTH L. SCOTT.

Bayswater, Feb. 12, 1861.

WATER SUPPLY OF LONDON.

SIR,—In the discussion at your last meeting, "On the present Condition of the Water Supply of London," in answer to a question from Mr. Braithwaite, I am reported to have stated that the net profits of the Plumstead, Woolwich, and Charlton Consumers Pure Water Company, amounted to £3,700 last year. This is a mistake. What I really said was, that from the 31st December, 1859, to the 31st December, 1860, according to the return made to me by the Superintendent of the Works (Mr. Haines), the gross income of the Company amounted to £3,700, and the working expenses, rent, taxes, &c., to about £2,200, thus leaving £1,500 profit.

In the above paper, in allusion to the supply of water obtained from the chalk by the Plumstead, Woolwich, and Charlton Consumers Pure Water Company, it is stated that "at Woolwich it is true that the Plumstead Company were obliged to sink or to bore to a maximum depth of 525 feet before they could get even a small supply of water," &c. Now this statement, no doubt unintentionally, is quite inaccurate. The Company derive their supply of water from the chalk, partly from long adits or small tunnels driven in the chalk from near the bottom of the well, and partly from two bore holes. The tunnels are from 8 to 10 feet high, and 6 feet wide, and the bottoms of these tunnels are situated at a depth of only 30 to 40 feet below ordnance datum or the mean level of the sea. The two bore holes, one about 6 inches diameter, and the other 18 inches diameter, are sunk to a depth of about 540 feet below the level of ordnance datum. The adits or tunnels yield a large supply of water, as well as the bore holes, and water of the same quality is readily procured either by tunneling or by borings. I may add that the water, both from the tunnels and the bore holes, rises to the level of ten feet above ordnance datum; that the present tunnels and bore holes yield about 1,200,000 gallons per day, and the quantity now yielded can be readily increased to a very large extent whenever this may be required.

I am, &c.,

SAMUEL COLLETT HOMERSHAM.

19, Buckingham-street, Adelphi, Feb. 13th.

SIR,—Observing in a paper "On the Present Condition of the Water Supply of London," by Mr. G. R. Burnell, published in the *Society of Arts Journal* of the 8th inst., a

statement that "the softened water of the Plumstead Waterworks Company acted very rapidly indeed upon the lead cisterns and services exposed to it," and such a statement being so contrary to what is truly the case, you will perhaps allow me space to contradict it.

I have made a great many very trying experiments with this softened water upon lead, and have found it to have scarcely any action whatever upon that metal, practically no action; indeed it may be almost taken as a rule that water submitted to the softening process of Dr. Clark will not act upon lead, and this is the case even with many waters, which, before the process had been applied to them, would have so acted. I speak without hesitation, from having made a vast number of experiments into numerous waters, and varying in quality.

I am, &c.,

DUGALD CAMPBELL.

Analytical Chemist to the Brompton Hospital, &c.
7, Quality Court, Chancery Lane, Feb. 13th, 1861.

THE LATE EARL OF DUNDONALD AND THE SPEED OF STEAM SHIPS.

SIR,—Any reminiscence suggestive of the genius and daring of Admiral the late Earl of Dundonald will now, doubtless, be regarded with historic interest, if not as of present public importance; I therefore beg to record that when in conversation with the late Earl of Dundonald, in 1848, I mentioned that the *Banshee*, a vessel built for the Irish Mail Service, and just then tried, had attained the then unprecedented speed of 16 knots or 18½ statute miles per hour, his lordship immediately replied, "Had I the command of such a vessel I would carry no guns: I would run up alongside of and board every ship that I could catch." On this principle of procedure, by thus entirely or in great measure dispensing with the weight of armament, and appropriating it to engine-power, whereby the utmost speed may be obtained by an invulnerably armoured or otherwise unsinkable ship, naval warfare, notwithstanding modern ordnance, may yet be reduced to its nominal condition of personal prowess, so congenial to the qualifications and taste of British seamen as exemplified by Nelson's capture of the *San Josef*, the late Lord Dundonald's capture of the *Gamo*, and by numerous other examples with which the naval history of Britain abounds. Take, for example, such a vessel as the *Warrior*, of 9,000 tons load displacement. Assuming the data of her construction and equipment as published in the *Times* of 29th December last to be correct, if 1,070 tons be taken from her armament of 1,500 tons, still leaving 430 tons of armament, and applied to increasing her engine-power from 950 tons weight up to 2,020 tons, the speed of the vessel would then be increased, from the present contemplated speed of 14 knots up to 18 knots per hour; and with the present supply of 950 tons of coal the steaming endurance of the vessel would be as follows:—

At 10 knots per hour the consumption of coal would be 55·6 tons per day, lasting 17 days.

At 12 knots per hour the consumption of coal would be 96 tons per day, lasting 10 days.

At 14 knots per hour the consumption of coal would be 152 tons per day, lasting 6½ days.

At 16 knots per hour the consumption of coal would be 228 tons per day, lasting 4 days.

At 18 knots per hour the consumption of coal would be 324 tons per day, lasting 3 days.

I am, &c.,

CHAS. ATHERTON.

Woolwich Dockyard, Feb. 7th, 1861.

BOILER EXPLOSIONS.

SIR,—Many of the accidents incident to steam boilers happen at the moment of starting, as well as at the instant of relieving the safety valve when the steam has unduly accumulated. No satisfactory explanation of the cause of this class of phenomena has ever yet been offered, but, although the cause may be unknown, the remedy is self-

evident. That is to say, it will be merely necessary to provide an exit for the steam, of some certain magnitude, that shall be invariably open during the whole time of inaction, when the regulator is shut; and affording a regular and continuous flow of steam from the boiler during the interval of rest of the engine.

It is highly probable that the spheroidal state which water assumes under variable and capricious circumstances, is at the bottom of those explosions which take place on starting the engine, or relieving the safety valve to allow of the escape of a super-abundance of steam.

This remedy will, of course, have no effect in the ordinary and normal cases of explosions from defective boiler plate, excessive steam pressure, or redhot plates from stoppage of feed, causing the decomposition of the water when re-admitted.

I am, &c.,

HENRY W. REVELEY.

Poole, February 4th, 1861.

MEETINGS FOR THE ENSUING WEEK.

- MON.** ...Architects, 8. Mr. T. L. Donaldson, "Description of Mons. Mariette's Excavations at Ghizeh and Saccara; Some Observations upon the Domestic Architecture of the Ancient Egyptians as existing among the present Arabs; and an Account of Catacombs at Alexandria, recently discovered;" being Notes made during a recent visit.
- TUES.** ...Royal Inst., 3. Professor Owen, "On Fishes."
- Statistical, 8. Mr. F. Jourdan, "On the Effects of Gold Supplies on the Foreign Exchanges, and on the price of Silver."
- Civil Eng., 8. Mr. Francis Fox, "On the Results of Trials of varieties of Iron Permanent Way."
- Pathological, 8.
- WED.** ...London Inst., 7.
- Geological, 8.
- Society of Arts, 8. Mr. George Ledger, "On the Alpaca, and its introduction into Australia."
- THURS.** ...Royal Inst., 3. Professor Tyndall, "On Electricity."
- Chemical, 8. 1. Dr. Thudichum, "On Putrefaction of Bile, and Formation of Gall-stones." 2 Dr. Guthrie, "On Bisulphide of Iodine." 3 Mr. Adie, "On Ground Ice."
- Linnæan, 8.
- Antiquaries, 8½.
- Royal, 8½.
- FRI.** ...Royal Inst., 8. Professor Faraday, "On Platinum."
- SAT.** ...Royal Inst., 3. Dr. E. Frankland, "On Inorganic Chemistry."
- Botanic, 3½.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[From Gazette, February 8th, 1861.]

Dated 5th December, 1860.

2988. C. J. Duméry, 29, Boulevard St. Martin, Paris—A new or improved apparatus for extracting from water or any liquid the bodies in dissolution or in suspension contained therein.

Dated 14th December, 1860.

3080. H. Barber, Belgrave, Leicestershire—Imp. in lamps used in mines.

Dated 17th December, 1860.

3099. M. Henry, 84, Fleet-street—Imp. applicable to fishing nets. (A com.)

Dated 18th December, 1860.

3113. J. H. Johnson, 47, Lincoln's-inn-fields—An improved compound felted and textile fabric. (A com.)

Dated 20th December, 1860.

3128. T. Sykes and B. C. Sykes, Cleckheaton, Yorkshire—Imp. in furnaces.

Dated 26th December, 1860.

3160. F. Warren, Birmingham—Imp. in the machine used for cleaning cotton, and commonly called a "churka," or "roller gin."

Dated 28th December, 1860.

3182. W. E. Newton, 66, Chancery-lane—Improved machinery to be used in the manufacture of paper. (A com.)

Dated 4th January, 1861.

19. G. Lowry, Salford—Imp. in machinery for heckling flax and other fibrous materials.

Dated 5th January, 1861.

39. J. Hamilton, Glasgow—Imp. in governors for regulating the speed of steam and other engines.

Dated 8th January, 1861.

48. P. E. Chassang, 9, Rue du Conservatoire, Paris—An improved buckle. (A com.)

Dated 9th January, 1861.

53. W. Taylor, Nursling, near Southampton—A combined heating and ventilating pipe, to be made elliptically or otherwise.

Dated 10th January, 1861.

61. M. F. Halliday, 4, Langham-chambers, Langham-place, Westminster—An improved trigger for gun locks.

Dated 11th January, 1861.

70. C. Senior, Huddersfield—Imp. in machinery or apparatus for tentering or stretching and drying woollen or other textile fabrics, also for drying warps, yarns, or fibrous substances.

84. A. M. Foote, New York, U.S.—An improved lock for receiving and securing umbrellas, canes, and similar articles.

Dated 12th January, 1861.

90. T. Warwick, Birmingham—Imp. in governors for steam and other engines.

98. G. Franci, 29, Boulevard St. Martin, Paris—Imp. in cannon and mortars and in projectiles for the same.

Dated 16th January, 1861.

129. R. W. Swinburne, South Shields—Imp. in the manufacture of plate glass, and in furnaces employed therein.

Dated 17th January, 1861.

134. M. F. Cavalerie, 29, Boulevard St. Martin, Paris—Imp. apparatus for obtaining motive power by centrifugal force.

Dated 19th January, 1861.

146. W. Crozier, Witton Gilbert, Durham—Imp. means of communication on railways for the prevention of accidents.

Dated 21st January, 1861.

160. W. Pickstone, 32, York-street, Manchester—Imp. in trucks or waggons for carrying coals.

162. W. Pickstone, 32, York-street, Manchester—Imp. in apparatus for discharging water from steam pipes.

164. H. Hibbing, 14, Blomfield-street North, Kingsland-road—Imp. in the manufacture of high boots, gaiters, knickerbockers, leggings, and other such articles.

Dated 22nd January, 1861.

168. C. Duckworth, Pendleton, Lancashire—An improved mode of manufacturing fabrics for useful and ornamental purposes.

172. E. Ellis, Bangor, Caernarvon—Improved machinery or apparatus for picking and cleaning "oakum," and for spinning or twisting the same for the purpose of calking ships or vessels.

174. H. R. Cottam, St. Pancras Iron Works, Middlesex—Imp. in folding chairs, cots, and such like articles to sit and recline on.

Dated 23rd January, 1861.

178. D. Smithies, Rochdale road, Manchester, and J. Jackson, Holyrood-terrace, Queen's park, near Manchester—Imp. in the manufacture of heads or harness for weaving.

179. W. Westley, Northampton—Imp. in the manufacture of boots and shoes.

180. W. Brown, Wigan—An improved stripper of carding for carding engines.

181. W. Clark, 53, Chancery-lane—Imp. in thrashing machines. (A com.)

182. W. Clark, 53, Chancery-lane—Imp. in circular looms for weaving hats and other articles. (A com.)

183. W. Clark, 53, Chancery-lane—Imp. in ships' sails. (A com.)

184. J. Deakin, Birmingham, and J. Cresswell—Certain imp. in shutters.

185. W. Wilson, Newcastle-upon-Tyne—Imp. in the manufacture of hats.

166. A. Prince, 4, Trafalgar-square, Charing-cross—An improved induction and eduction valve for steam engines.

187. R. A. Brooman, 166, Fleet-street—Imp. in sewing machines, particularly applicable to the stitching or sewing of gloves and other articles where circular or partially circular parts are to be connected together. (A com.)

Dated 24th January, 1861.

188. T. Haworth, Nut Mill, Bacup, Lancashire—Imp. in machinery or apparatus for governing or regulating the speed of steam engines or other motive power.

189. H. Henderson, Edinburgh—Imp. in machinery or apparatus for printing yarns or threads, part of which machinery or apparatus is applicable to the twisting of fibrous materials.

191. R. Thomas, Bath-street, Tabernacle-square, Middlesex—Imp. in tires of wheels for vehicles used on common roads.

192. Col. H. D. O'Halloran, Kensington—An improved sporran or excursion bag especially suitable for volunteer riflemen and tourists.

193. G. T. Selby, Smethwick, Staffordshire—Imp. in the construction of masts and posts.

194. T. Gibson, Staveley Works, Derby, and W. Knighton and H. Knighton—Imp. in core barrels for casting pipes, cylinders, retorts, and other like hollow articles.

195. D. J. Fleetwood, Birmingham—Imp. in apparatus for rolling metal.

196. W. Longmaid, Inver, Galway, Ireland—Imp. in the manufacture of iron and steel.

Dated 25th January, 1861.

199. E. F. Hughes, 123, Chancery-lane—Imp. in machinery or apparatus for pulverising clay and other materials. (A com.)

200. G. Hadwen, Audenshaw, Lancashire—Imp. in the double lift jacquard machine as applicable to power looms.
201. R. A. Brooman, 166, Fleet-street—Imp. in reaping and mowing machines. (A com.)
202. S. Needham, Oriell-place, Chelsea—Improved spring apparatus applicable to bedsteads and other articles to which springs may be applied.
205. A. F. Yarrow, Arundel-square, Barnsbury, and J. B. Hilditch, Barnsbury-villas, Middlesex—Imp. in means or apparatus used in ploughing, tilling, or cultivating land.
206. C. Lungley, Deptford-green Dockyard—Imp. in the construction of ships and other vessels for war purposes.

Dated 26th January, 1861.

207. J. Durrant, Fitzroy-square, and N. A. Harris, Bayswater, Middlesex—Imp. in the form and construction of chimney tops or appliances for surmounting chimneys, in order to regulate the up currents and obviate the down draughts.
208. C. Bishop, St. Helen's, Lancashire—Imp. in the ornamenting of glass.
209. C. A. Drevet, 4, South-street, Finsbury—Imp. in the manufacture of sulphurous acid, sulphites, bi-sulphites, and sulphuric acid, and in the apparatus employed therein, and in the application of one of the products of such manufacture to the bleaching of textile, animal, and vegetable substances.
210. T. Bradford, Manchester—Imp. in machines for washing, rinsing, and blueing clothes, fabrics, yarns, and similar articles.
211. F. W. Webster, Whitstable, Kent—Improved apparatus applicable for washing and churning.
213. R. Mushet, Coleford, Gloucestershire—An imp. or imps. in the manufacture of melting pots or crucibles.
214. J. Arrowsmith, Bilston, Staffordshire—Imp. in the manufacture of armour plates for gunboats and land batteries, and in machinery and furnaces used in the said manufacture.
215. G. Hallett, 62, Broadwall, Lambeth, and J. Stenhouse, 17, Rodney-street, Pentonville—Imp. in the manufacture of pigments for coating surfaces.
216. H. Bessemer, Queen-street-place, New Cannon-street—Imp. in ordnance and projectiles.

Dated 28th January, 1860.

217. J. Clark, 28, Harleyford-place, Kennington—The application of a paste of whatever wood to any kind of ornamental and other mouldings, without the least admixture of any other materials, or use of any chemical agent. (A com.)
219. C. De Bergue, 9, Dowgate-hill—Imp. in machinery for shaping metals.
221. H. W. Hart, 3, Rue Bergère, Paris—Imp. in gas burners.
223. G. A. Rothholz and M. Rosenthal, 14, Goulston-street, Whitechapel—An improved combined garment for gentlemen's wear.
225. W. E. Newton, 66, Chancery-lane—An imp. in dinner-plates. (A com.)
227. J. G. Mason, Ironmonger-street, Stamford, Lincolnshire—Imp. in chimney tops.

Dated 29th January, 1861.

231. E. W. Furrell, Kensington—An improved means of communication between the guard and the engine driver of a railway train.
233. W. F. Fleming, Halifax, Yorkshire—An imp. in "bottle cleaners."
235. J. H. Ashford, Loxbeare, Tiverton—Imp. in signals for communicating between the passengers of railway trains and the engine-driver and guards.
237. R. Culverwell, Plymouth—Improved apparatus for obtaining motive power or communicating motion to machinery.
239. C. E. Crawley, 17, Gracechurch-street, and T. Schneider, 74, Horseferry-road—Imp. in safety and other lamps.

Dated 30th January, 1861.

241. A. Courtois and J. E. de Soulange, Paris—Improved construction of kiln for baking bricks, tiles, or other similar articles.
243. S. T. Crook, Halifax, Yorkshire—Imp. in the construction of boilers employed for warming buildings.
245. W. Archer, Bolton, Lancashire—Certain imp. in jacquard machines.
247. J. Poole, Bletchley, Buckinghamshire, and J. Wright, 42, Bridge-street, Blackfriars—Imp. in steering or guiding steam or other vessels, and also in working or actuating their rudders.

249. H. Phillips, Pinhoe, Devonshire, and J. Bannehr, Exeter—Imp. in urinals, and the manufacture of manure when urine is used.
251. G. T. Bousfield, Loughborough-park, Brixton—Imp. in the manufacture of shoes for horses and other hoofed animals. (A com.)
253. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in the construction and internal arrangement of railway carriages. (A com.)
255. W. Clark, 53, Chancery-lane—Improved spring hinges. (A com.)

INVENTION WITH COMPLETE SPECIFICATION FILED.

255. T. Lemeille, 51, High Holborn—Engines for the extraction of the produce of mines, and new arrangement of the ropes for suppressing all dead weight.—1st February, 1861.

PATENTS SEALED.

[From Gazette, February 8th, 1861.]

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| <i>February 7th.</i> | 1903. F. Hudson. | 1943. J. Giles. |
| 1904. J. Bonne. | 1950. T. Hart. | 1951. C. P. E. Poussier. |
| 1905. C. L. Davies. | 1956. J. Stuart. | 1965. N. Wehnert. |
| 1908. R. A. Brooman. | 1966. J. Lark. | 1968. E. Wroughton & T. Holmes. |
| 1912. E. M. Thornion. | 1979. W. Walton. | 1997. A. Pirotte. |
| 1914. R. A. Brooman. | 2017. W. Thomson & F. Jenkin. | 2096. J. H. Johnson. |
| 1915. R. A. Brooman. | 2096. J. H. Johnson. | 2160. J. S. Travis. |
| 1917. F. Davidson. | 2195. C. Cowper. | 2733. W. Cooke. |
| 1921. J. Barlow. | 3087. J. R. Cooper. | |
| 1923. M. Dodds. | | |
| 1924. E. Smith. | | |
| 1927. D. F. Grimaldi. | | |
| 1928. H. Earle and W. Earle. | | |
| 1929. H. Cockey & F. C. Cockey. | | |

[From Gazette, February 12th, 1861.]

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| <i>February 12th.</i> | 2015. E. Hall. |
| 1954. S. Norris. | 2017. A. M. Perkins. |
| 1955. H. Hewatson. | 2031. C. Weiss. |
| 1963. J. Billing. | 2033. J. H. C. Lacroisade. |
| 1969. R. D. McKibbin. | 2048. G. Davies. |
| 1971. H. Courtrot. | 2055. R. Jobson and R. J. Ransome. |
| 1972. W. Jenkinson. | 2068. J. Bingley. |
| 1976. W. Holmes and J. Oldfield. | 2073. H. Marriott. |
| 1978. P. A. Godefroy. | 2077. B. Hirst. |
| 1982. J. Samuel and G. F. Train. | 2092. H. Mege. |
| 1985. W. Petrie. | 2093. A. A. Beaumont. |
| 1987. T. Melldew and C. W. Kesselmeier. | 2217. N. Rosinsky. |
| 1988. J. J. Coleman. | 2224. J. H. Johnson. |
| 2001. W. H. Crispin. | 2251. A. V. Newton. |
| 2003. R. Romaine. | 2257. G. F. Smith. |
| 2004. F. B. Houghton. | 2608. F. S. Barff. |
| 2005. T. Grahame. | 2878. T. Gamble and E. Ellis. |
| 2009. E. Bridgman. | |

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

[From Gazette, February 8th, 1861.]

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| <i>February 4th.</i> | 279. W. Spence. |
| <i>February 5th.</i> | 233. R. W. Johnson and W. Stableford. |
| <i>February 7th.</i> | 252. J. Chatterton. |
| 242. E. Leigh. | 257. G. A. Barrett, W. Exall, and C. J. Andrewes. |
| 300. J. E. Boyd. | |
| 390. D. Nurse, R. Nurse, and G. Nurse. | 250. R. Aytoun. |
| <i>February 8th.</i> | 255. L. Cass. |
| 245. R. Carie. | 288. W. Cope. |

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

[From Gazette, February 8th, 1861.]

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| <i>February 5th.</i> | 428. E. Massey. |
| <i>February 7th.</i> | 328. H. Warner, J. Haywood, and W. Cross. |
| 325. B. H. Hine, A. J. Muddella, and L. Barton. | 332. W. Whiteley. |

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Registry.	Date of Registration.	Title.	Proprietors' Name.	Address.
4327	Jan. 17.	The Alpha Tie and Collar	Alexander Grant and Bros. ...	Clement's-court, Wood st., Cheapside.
4328	" 18.	Air Furnace for melting and refining iron...	John Clayton	Wolverhampton.
4329	" 18.	Crib biting and wind-sucking preventor ...	John Cassidy	Dublin.
4330	" 21.	Fire Lighter making machine	James Adams	47, Alfred-road, Westbourne-park, W.
4331	" 28.	The Commissionaire's Porte Circular ...	Capt. Edward Walter ...	Army and Navy Club, S.W.
4332	" 30.	Sash Fastener	Lingham, Bros.	Birmingham.
4333	Feb. 11.	Lamp Burner... ..	Gray, Bailey, and Bartlett ...	Ditto.
4334	" 11.	The Elcho Rifle-firing Rest	{ Francis Charteris, Lord } Elcho, M.P.	St. James's-place, S.W.
4335	" 11.	Break Spring	Robert Watson	40, Walton-street, Chelsea, S.W.